ELECTRICAL REVIEW

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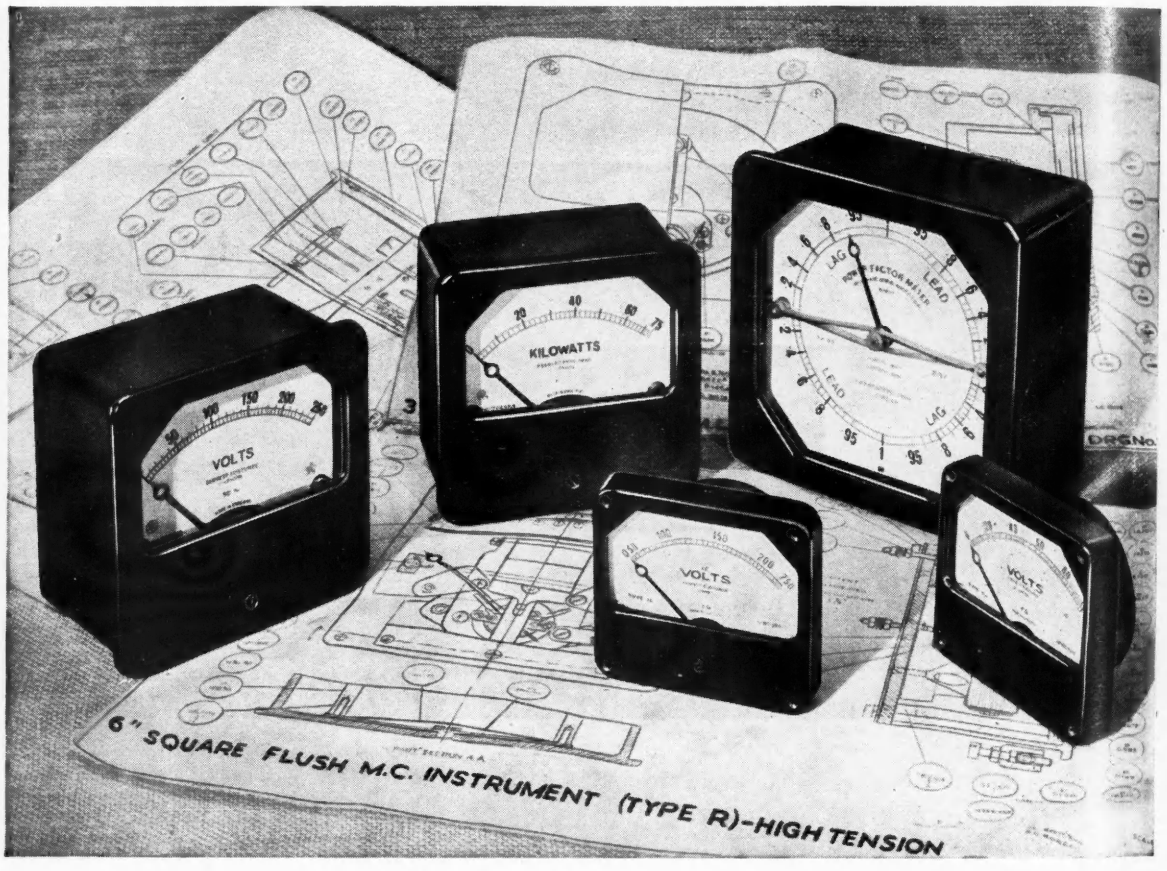

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ELECTRICAL REVIEW

29 January 1954 Vol. 154 No. 5 Established 1872

Steam Temperatures

RISING fuel costs may not represent entire loss if they stimulate efforts to secure greater thermo-dynamic efficiency that will lessen the amount of fuel required to produce each kilowatt-hour. The most important ultimately of the methods adopted to this end is a fuller use of heat in steam through extending its useful temperature range. In practice this means raising the initial temperature, since the value at the turbine exhaust is fixed, mainly by the temperature of the cooling water for the condenser. There is also the associated factor of pressure, in view of its relationship with saturation temperature.

What is being done or can be done to exploit the potentialities of this means of fuel economy was the subject of the Thomas Lowe Gray lecture, reported in this issue. Although Dr. T. W. F. Brown was primarily concerned with turbines for marine propulsion, the section of his lecture relating to those installed for generating electricity on land is of more immediate moment, since the more arduous duties of sea-going plant restrict the rate of advance in steam conditions. Examples taken from existing and projected power stations gave a broad perspective of world trends. They included some particulars of B.E.A. turbo-alternators now being built for 1,050 deg F, which appears to be a general upper limit set at present by risk of metal deformation with time (creep), although 1,150 deg F is allowed for in designs in the U.S.A. and Dr. Brown suggests 1,350 deg F as a possibility with metals now available. He also pointed out the significance of high temperature research in the closely related field of the gas turbine. The reheat cycle, pioneered in Great Britain more than thirty years ago, was shown to have become a standard feature of larger generating sets, but no reference was made apparently to their use in one-boiler one-turbine unit combinations. From particulars given of blade construction, it is to be inferred that near the exhaust end the blade tips revolve at considerably more than supersonic speed.

The lecturer dealt primarily with technical potentialities and touched upon economic aspects only incidentally. Apart from capital expenditure, many factors combine to make a gap between what is theoretically possible and what circumstances make feasible. These include such questions as the extent to which advantage can be taken of the largest capacities owing to deficiencies in water supply and difficulties in transmitting the output from power station sites to load centres. A further and still unresolved problem is the effect on boiler availability of certain salts in some British coals which tend to form deposits in superheaters operated at very high temperatures. Nevertheless there is every reason to believe that the gap between the ideal and the expedient will be progressively narrowed.

SCOTTISH SEGREGATION

Scottish nationalists and advocates of combined generation, transmission and distribution will welcome the Electricity Reorganization (Scotland) Bill which received its first reading in the House of Commons last week. The principal purpose of this measure is to remove Southern Scotland from the ambit of the British Electricity Authority and to place generation, transmission and distribution in the hands of a new Board. The existing division of South Scotland will be retained, in altered form, by the setting up of " executives " for the eastern and western parts of the area, although general financial control and control of charges will be exercised by the parent Board. That portion of British Electricity stock or money borrowed by the British Electricity Authority attributable to the South of Scotland is to be regarded as a loan from the B.E.A. to the new Board. Apart from this, the Board may borrow up to £75 million and its loans may be guaranteed by the Treasury. Presumably in the remote possibility of the Board's being unable to meet its obligations the English (and Welsh) taxpayers would help the Scottish taxpayers to make good the deficit. Independence is retained by the North of Scotland Hydro-Electric Board and widened by the annulment of the requirement that it should submit its constructional schemes to the British Electricity Authority for approval.

CONDITIONS OF EMPLOYMENT

It was provided in the Electricity Act, 1947 (Section 53) that the British Electricity Authority should negotiate with the appropriate employees' organizations " machinery " for settling terms and conditions of employment in the nationalized industry as well as dealing with safety, health and welfare. The new Scottish Bill is designed to amend that Section by bracketing the North and South of Scotland Boards with the B.E.A. Sub-section (1) of Section 53 of the 1947 Act is to be amended to provide that agreements with these appfopriate organizations on the establishment and maintenance of the " machinery " may be negotiated by " these Electricity Boards or *any of them.*" This seems to imply that the present system, embracing both England and Scotland, may not be retained and that in course of time attempts may be made to institute separate arrangements for employees of the Scottish Boards. There are indications that the " appropriate organizations " do not view this prospect very favourably and that the matter will be raised on their behalf during the second reading debate on the Bill in a week or two's time.

WAGES AND EXPORTS

The engineering employers' main argument against higher wages is the effect which an increase would have on the prices of equipment shipped abroad. Already, they have pointed out, there has been a slackening of orders because overseas customers are being offered lower prices by Great Britain's competitors. Sir Percy Mills told the Court of Inquiry which has been dealing with the question that the employers were apprehensive as to the industry's ability to maintain exports at the present level if wages were raised, let alone secure the substantial increase in overseas trade which was essential to the country's economy. It was contended by Mr. J. Tanner on behalf of the trade unions that the 15 per cent wage increase for which they were asking would cost about £75 million a year and would add only about 3 per cent to the industry's total costs. Sir Percy Mills agreed that the figure for the workers covered by the Engineering Employers' Federation would be about the level quoted by Mr. Tanner but said that if the increase were to be applied to all the workers in the engineering and allied industries the total would be over £170 million.

AMERICAN IMPORT POLICY

Last week we commented on British trade with the United States, expressing the hope that the Americans would show a better appreciation of the situation. We consequently welcome the report of the Randall Commission on United States foreign economic policy published last Saturday. The Commission thinks that American economic aid should be ended as soon as possible and instead a number of measures instituted or intensified to enable America's debtors to pay their own way. Increased American investment overseas is recommended and suggestions are made for easing the way of American concerns in pursuing this aim. Under the Trade Agreements Act the President has had power to negotiate reciprocal tariff reductions; it is proposed that this power shall be extended for three years and also that he should have additional powers in the matter of tariff reductions. Perhaps the most important recommendation for British electrical manufacturers is that the Buy American Act should be drastically amended in favour of foreign tenderers. It is this Act which has been a formidable handicap to the entry of British electrical plant to the United States. These are comforting words to British industrialists but their effect is somewhat modified by the strong dissent of an influential minority in the Commission.

EXPORTS IN 1953

While exports of electrical equipment from this country last year were, in the aggregate, below the peak value reached in 1952, the total nevertheless represents a considerable achievement in the face of growing foreign competition. Overseas sales of British-made plant of a capital nature continued at a high level. Manufacturers of transformers, in particular, gained further success, exporting equipment to the total value of £12·4 million—£2 million more than in the previous year. In the case of generating plant, the value of exports (£16·8 million) was only slightly below the 1952 figure, while that of electric motors declined by 8 per cent to £9·8 million. In assessing future prospects, it may be noted that the value of electrical exports in the last quarter of 1953, at £45·3 million, was higher than in any of the three preceding quarters.

S.T.S. Velletia (28,000 dead weight tons), flagship of the Shell tanker fleet, passes into the Queen Elizabeth II Dock at the opening ceremony on 19th January. She was carrying 26,000 tons of crude oil from Kuwait in the Persian Gulf (Shell photo)

New Eastham Oil Dock

Electro-Hydraulic Operation of Lock Gates

To cope with the new tanker traffic resulting from the opening of the Shell Petroleum Company's latest refinery at Stanlow, the Queen Elizabeth II oil dock, the biggest of its kind in the country, has been constructed and was officially opened on 19th January. It is situated adjacent to the entrance locks at Eastham, and covers an area of 18¾ acres; it is capable of accommodating four 30,000 ton tankers at one time.

Giving access to a 900ft square basin with three handling gantries designed for future electrification, the dock possesses its own entrance lock 807ft long, 100ft wide and 60ft deep. It has three caisson type gates, the intermediate one, 200ft from the river entrance, providing an economical and speedy means of dealing with smaller vessels instead of having to fill or empty the entire length of the lock.

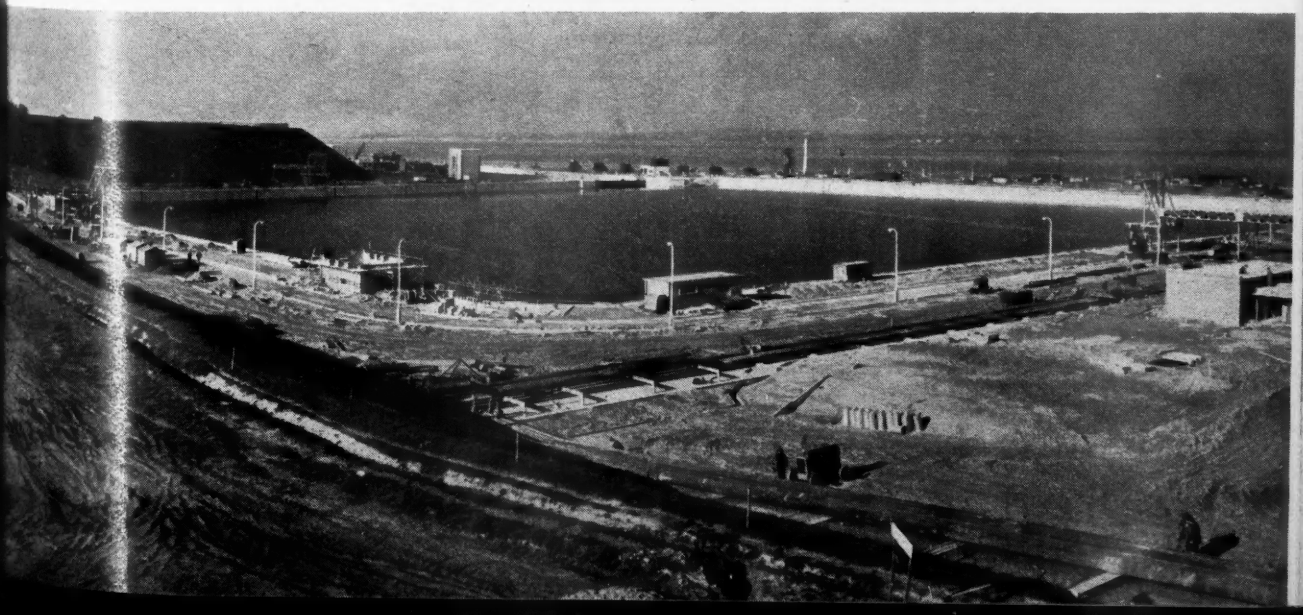
The gates, which are interchangeable, weigh 1,700 tons each, including 800 tons of concrete ballast. Two electrically driven pumps of 100 tons per hour capacity are incorporated in the structure for further ballasting and trimming purposes. The gates, supplied and installed by Vickers-Armstrong, Ltd., operate horizontally, the intermediate one being usable as a dry dock to facilitate repair and maintenance. It takes four minutes to open or close the gates.

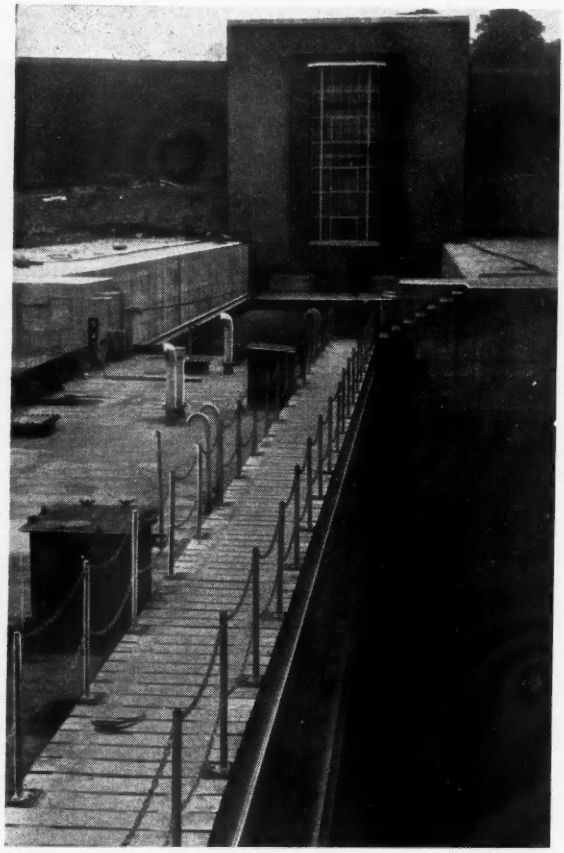
Operating each gate are two sets of "V.S.G." electro-hydraulic hauling machinery, giving a hauling speed of 40ft per minute using two sets and 20ft per minute with one set, by using a change speed gear box. Basically one set of hauling machinery consists of a 125 b.h.p. 3-phase, 416 V 490 r.p.m. motor driving a variable delivery pump supplying oil under pressure to a rotary hydraulic motor which rotates the winch drums through various trains of gearing.

The "V.S.G." hydraulic drive allows smooth infinitely variable speed variation from zero to full speed whilst regulating the speed of haulage automatically to suit the load. It ensures that the designed horse power is not exceeded, yet the gear is able to exert a high torque and to work over a large torque range. In the event of an overload the automatic control gently stalls the machine, maintaining full load, without risk of damage or stopping the electric motor. As the electric motor has to start only against a very light load a squirrel cage machine is used, with direct-on-line starting.

Movement of the gate is controlled from two points: adjacent to the hauling machinery or remotely from the side of the entrance lock. Either controller operates a 1 h.p. electric reversing pilot motor which regulates the amount of fluid discharged by the pump to the hydraulic motors, thereby controlling the speed and direction of the gate. The motors were supplied by the British Thomson-Houston Co., Ltd., the control gear by the Electrical Apparatus Co., Ltd., and the "incoming" switchgear by the Metropolitan-Vickers Electrical Co., Ltd. The control

The new dock from the south-west looking towards the lock entrance (Shell photograph)





The centre lock gate and operating plant house and dry dock

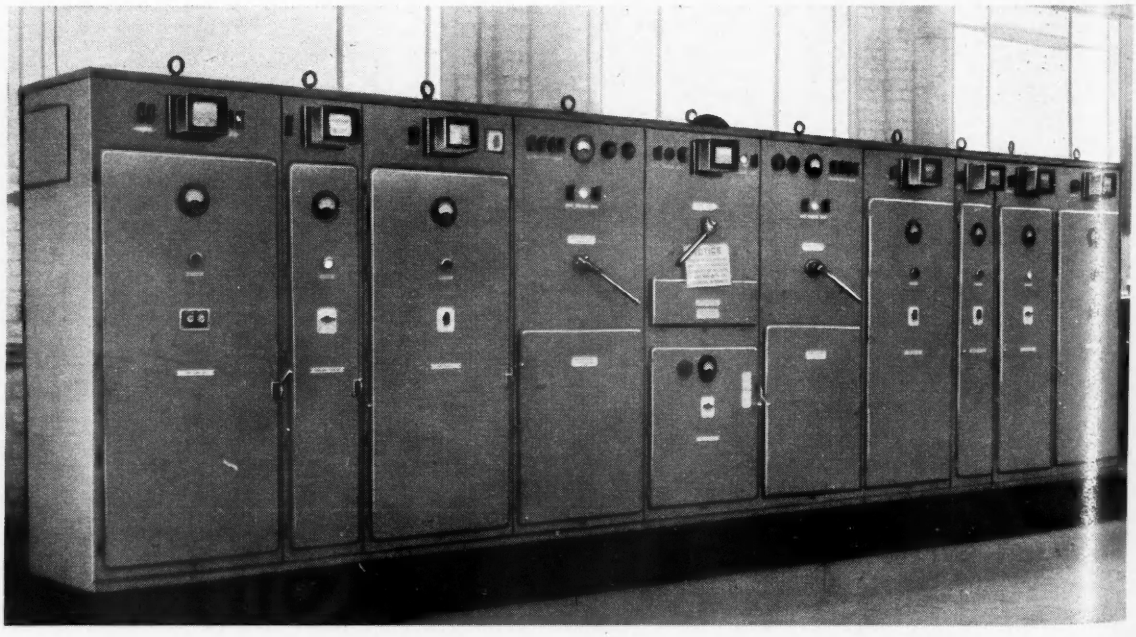
wiring and cabling was carried out by Vickers-Armstrong, Ltd., British Insulated Callender's Cables, Ltd., and the Manchester Ship Canal Co.'s own staff.

To guard against electrical failure, although the supply is duplicated, there are hydraulically operated capstans at each gate. Hydraulic pressure for moving the sluices on the new lock and for operating the gates and sluices on the existing locks is provided by two electrically driven pumps situated in the power house about half a mile from the locks. The pumps and motors are of Mather & Platt make, the pumps having an output of 333 gal/min at a 1,750ft head, and the 280 b.h.p. 3-phase 416 V motors running at 2,940 r.p.m. Brookhirst direct-on-line control gear is employed. Again to guard against supply failure there is a duplication of plant. This takes the form of three 200 gal/min Mather & Platt pumps driven by Crossley 184 h.p. diesel engines. Incidentally these pumping sets occupy about four times the floor area taken by the electrically driven sets and two units are required to give the same duty as one of the latter. There are also diesel driven d.c. generators which are used to operate small auxiliary pumping plant. The engines are by Crossley Bros., Ltd., and the d.c. generators and switchgear by Metropolitan-Vickers Electrical Co., Ltd. This diesel pumping plant originally served the existing locks but the construction of the new oil dock has resulted in its supersession by the electrically driven plant except for stand-by purposes.

The building of the oil dock also entailed the provision of new 11 kV feeders in duplicate from the Plymyard substation of the Merseyside and North Wales Electricity Board. These feeders are in the form of a ring and in addition to supplying the oil dock they also serve the installation of the Shell Refining & Marketing Co., Ltd., from which the oil discharged at the oil dock is pumped to the refineries six miles away at Stanlow.

The Electricity Board's equipment at the intake point of the Ship Canal Company consists of a five-panel 11 kV 400 A Switchgear & Cowans type F.A. switchboard. The switches have a rupturing capacity of 150 MVA, and the incoming and outgoing feeders have " Solkor " protection. Two of the switches feed the adjacent main 11 kV switchboard of the Ship Canal Company which is of Reyrolle

Medium voltage control panel for the power house



make and consists of five type "C.T." 11 kV 400 A 150 MVA switches. Two of these control duplicate Ferranti 1,000 kVA 11 kV/416 V/240 V transformers for the power house installation, two control the ring feeders to the two other substations at the oil dock, and the fifth is a bus section switch.

The medium voltage switchboard in the main power house is of Brookhirst make and consists of contactor control gear for local services and for the pumping plant, which incidentally is automatically controlled by tappet switches operated by an accumulator, the frequency of switching depending upon the demand on the hydraulic system. The switchboard is fed from both ends by the 1,000 kVA transformers and there is a section switch in the centre. It is also possible to switch the local services panel to either section of the board should one section be "off" for maintenance purposes.

The equipment in No. 2 substation consists of five Reyrolle 11 kV 150 MVA rupturing capacity switches, similar to those in the power house substation (No. 1), two 750 kVA 11 kV/416 V/240 V Ferranti transformers feeding a Metrovick medium voltage switchboard from which supplies are taken to the three gate machinery houses and other services.

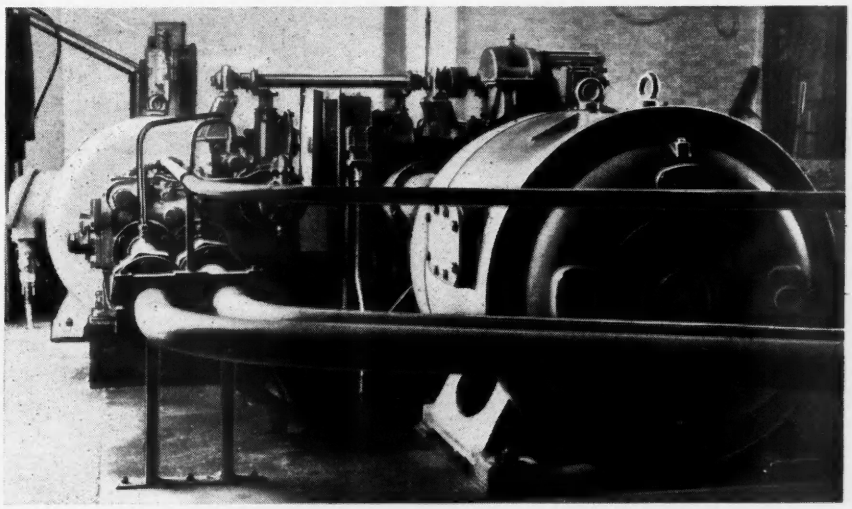
No. 3 substation has a four-panel Reyrolle 11 kV switchboard, one Ferranti 200 kVA 11 kV/416 V/240 V transformer, one Ferranti 11 kV/6·6 kV transformer and a Metrovick medium voltage switchboard. All feeder switches at the three substations have "Solkor" protection.

The 250 kVA 11 kV/6·6 kV transformer is required to operate an emergency hydraulic plant for fire purposes and if necessary to feed into the main hydraulic system. The plant consists of two 212 b.h.p. 6·6 kV Mather & Platt motor-driven pumps having an output of 250 gal/min at a head of 1,730ft. The control gear and auto-transformers are of Metrovick construction.

For the general illumination of the oil dock ninety-seven 250 W high pressure mercury vapour lamps in G.E.C. blown glass cut-off units are used. These are mounted at a height of 25ft on Concrete Utilities columns with a spacing of 100ft. To supplement these there are six 40ft transmission type columns, two per berth, each column carrying two 400 W h.p.m.v. lamps in G.E.C. modified apron floodlights. Two further 12ft columns carry G.E.C. floodlight projectors for lighting the lock entrance.

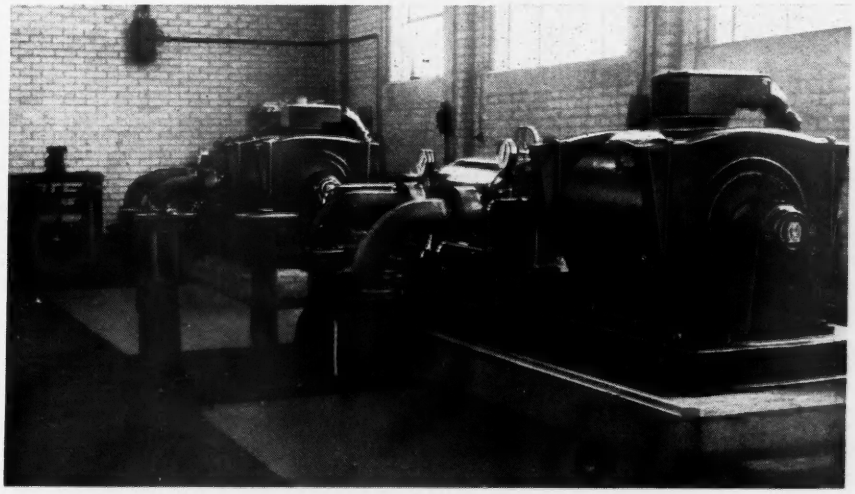
The cable which links Nos. 2 and 3 substations on opposite sides of the new lock and which passes underneath it is the most modern type of power cable. It was manufactured and supplied by the Telegraph Construction & Maintenance Co., Ltd., and is an 11 kV, 0·10 sq in 3-core, screened type, polythene insulated, wire armoured and served cable. As the insulation is impervious to water the provision of lead or other metallic sheath was considered unnecessary. The electrical, hydraulic and telephone services cross from side to side of the lock through a subway which passes under the lock and is served by two vertical shafts.

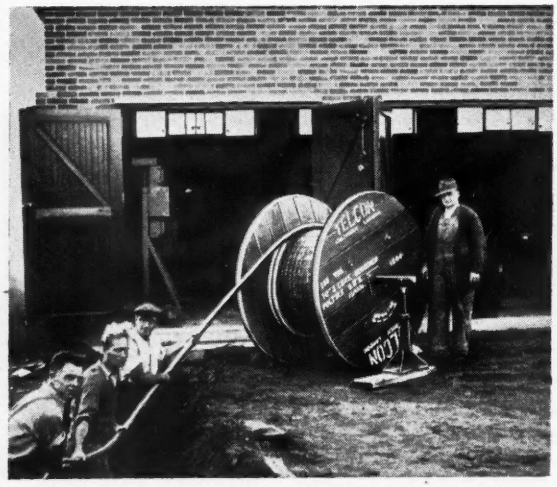
The cable was installed in three lengths totalling approximately 360 yd, those on each side of the lock being laid direct in the ground between the substations and the lock sides. The middle length was taken through the low level subway 135ft long under the lock, through 70ft deep vertical shafts at either end. In the shafts and subway the cable was secured in Greenheart cleats. Due to its light weight and flexibility, the cable could be handled and pulled with relative ease. Two straight joints were included in the run and the cables finally terminated at oil filled circuit breakers at the substation. This jointing and



The 125 h.p. main pump in one of the lock gate plant houses

The two 280 h.p. pumps which provide the hydraulic power for the three original locks





" Telcon " 11 kV polythene power cable being run off into a trench

terminal cable work was carried out by " Telcon " personnel.

Although requiring some special technique and care, a simple jointing procedure has been developed which it is considered can be acquired by any qualified jointer after a minimum of training and it employs material which has been developed by " Telcon " for joints in polythene cable. The material, " Telcohesive " tape, meets the insulating requirements and reproduces the non-hygroscopic qualities of the dielectric. Inclement weather during jointing operations at Eastham caused no apprehension.

The whole of the e.h.v. and m.v. distribution at the oil dock was carried out by the Merseyside and North Wales Electricity Board to the design of, and with assistance from, the company's electrical staff.

We are grateful to the Ship Canal Company and the Electricity Board for their assistance in preparing this article.

SCOTTISH ELECTRICITY

Details of New Bill

LAST week the Electricity Reorganization (Scotland) Bill was introduced into the House of Commons and received a first reading. The Bill provides (Clause 1) that the functions of the Minister of Fuel and Power in relation to electricity supply in Scotland shall be transferred to the Secretary of State and that a new authority—the South of Scotland Electricity Board—shall be set up to be responsible for the generation and supply of electricity in the part of Scotland outside the area of the North of Scotland Hydro-Electric Board.

The powers of the Minister of Fuel and Power to make regulations relating to safety and the efficiency of supply of electricity are to be exercised jointly by the Minister and the Secretary of State. The certification of meters and the measurement of electricity is to remain in the hands of the Minister.

Clause 2 stipulates that the new Board will be appointed by the Secretary of State and it will take over on the vesting date (set down as 1st April, 1955) the functions of the British Electricity Authority relating to generation and transmission in the South of Scotland and the functions of the South East and South West Scotland Electricity Boards relating to distribution. Thus the new Board, like the North of Scotland Board, will be responsible for both generation and transmission and it will discharge those functions under the same powers as are exercised by the North of Scotland Board subject to certain exceptions set out in the first schedule to the Bill.

Clause 3 terminates the responsibility of the B.E.A. for approving constructional schemes prepared by the North of Scotland Board and dissolves the two existing South of Scotland Boards.

Clauses 4 and 5 require the new South of Scotland Board to prepare for the approval of the Secretary of State a scheme setting up two " executives "—one for the eastern and one for the western part of its area—to take over such of the Board's functions as may be specified in the scheme, other than general financial control and control of charges.

In the second part of the Bill, Clauses 6 and 7 transfer to the new Board the assets and liabilities of the two existing South of Scotland Boards and such assets and liabilities of the B.E.A. as are situated in the area or are held exclusively or mainly by the Authority for the purpose of its functions in Scotland. Consequential provision is made for the amendment of agreements, the application of contracts and other matters arising out of the transfer. Specific directions about the operation of the transfers under Clauses 6 and 7 are laid down in Clause 8 which also excepts from transfer the B.E.A.'s liability in respect of British Electricity stock or money borrowed in so far as this is attributable to the South of Scotland. Under Clause 9, which covers the financial settlement, that liability is treated as a loan from the B.E.A. to the new Board. Clause 10 provides for the reference of any questions arising under these clauses to the Minister of Fuel and Power and the Secretary of State for settlement.

Part III contains a number of financial provisions covering such matters as payments in lieu of rates and certain provisions of the Electricity Act, 1947, affecting the North of Scotland Board in relation to undertakings transferred to it under the Act (Clauses 11 and 12). Clause 12 also imposes a limit of £75 million on the amount which the new Board may borrow, in addition to any sums borrowed or treated as a loan under Clause 9, and empowers the Treasury to guarantee loans raised by the new Board.

Miscellaneous and general provisions are contained in Part IV. The settlement of disputes between the Scottish Electricity Boards (other than those arising out of transfers under the Bill) is provided for in Clause 13. Clause 14 provides for the payment of compensation to members and employees of existing Boards whose position is worsened as a result of the Bill. Provision for the payment of pensions to employees of the South of Scotland Board is made in Section 54 of the Electricity Act, 1947, as applied to that Board.

Clause 17 and the first schedule contain the necessary detailed adaptations of the Hydro-Electric Development (Scotland) Act, 1943, the Electricity Act, 1947, and the Electricity Supply Acts. Partial repeals of certain sections of the 1947 Act are made in the second and third schedules.

The Bill amends the 1947 Electricity Act to permit the supply by the South of Scotland Board of electricity to railways in England and Wales and by the B.E.A. to railways in Scotland with the approval of the other authority concerned in each case. The B.E.A. is empowered to provide bulk supplies of electricity to the Scottish Boards.

Copies of the Bill (price 1s) are obtainable from H.M. Stationery Office.

Corrosion of Grid Conductors

Experience with Steel-Cored Aluminium Overhead Lines

SERVICE experience of the effect of corrosion on steel-cored aluminium overhead line conductors (0·175 sq in copper equivalent) of the 132 kV grid during the past twenty years was described by Dr. J. S. Forrest and J. M. Ward (B.E.A.) in a paper presented on Wednesday before the Institution of Electrical Engineers Supply Section. Their experiments had shown the average rate of deterioration, in terms of loss of mechanical strength, to be 0·4 to 0·5 per cent for each year, corresponding to a mean service life of from twenty-five to thirty years.

Rate of deterioration was found to vary greatly. Line conductors in industrial areas (where solid pollution might be ten times that in rural areas) might have a life of less than ten years—in extreme cases only three years—whereas in rural surroundings they were still in excellent condition and were expected to last for at least fifty years. Earth wires generally deteriorated more slowly and normally had an estimated life of from thirty-five to fifty years, except when unprotected and exposed to wind and sea spray; under these conditions an earth wire had had to be replaced after three years.

Two types of corrosion had been found—industrial and coastal. In the first, exposed aluminium surfaces were attacked with some uniformity, often with deep pitting of the internal surfaces of the strands. Coastal corrosion was caused essentially by electrolytic attack between the aluminium and the steel core and between the aluminium layers. Analyses of results from 95 conductors in inland districts showed that the outer strands corroded more rapidly than the inner. On the other hand in 34 samples from coastal districts the rates of attack were similar for outer and inner strands. In severe cases, however, the inner strands in contact with the steel wire were much more badly damaged, often accompanied by a characteristic bulging of the conductor. In coastal districts sheltered from salt spray, corrosion was only slightly greater than in rural districts.

The steel core of all conductors examined was in good condition, even when the aluminium was severely corroded, which confirmed the view that the attack was electrochemical. S.c.a. conductors appeared to corrode appreciably faster than large aluminium surfaces, such as roofs; this was held to be due mainly to the retention of moisture between the strands of the conductors and to the electrostatic effect of voltage in attracting solid particles, this effect probably explaining the slower deterioration of earth wires compared with line conductors.

Method of Treatment

Treatment of conductors with suitable greases had proved effective in preventing corrosion under the worst conditions likely to be encountered. Higher costs of manufacture and erection (about 5 per cent) were small in comparison with savings (48 per cent of annual costs) in replacement, since an average increase in life of ten years could be expected. Maximum protection in industrial districts called for complete impregnation, including a thin layer of grease on the outside of the conductor. In coastal districts the external layer could be omitted to reduce erection costs, provided enough grease were applied to the penultimate layer to squeeze through the interstices between the outer strands and thus seal the conductor. Bitumen was not an effective corrosion preventive, since in time it cracked, hardened or disintegrated. Paint and plastic protection did not fully comply with the requirements.

Estimates of life were based on 12 per cent loss in strength of a whole conductor. If the steel core retained its strength (as was usual), this limit was reached when the aluminium strands had lost 30 per cent of their initial strength. Increase in electrical resistance provided a good measure of corrosion and corresponded broadly to decrease in ultimate mechanical strength. Local corrosion or pitting had little effect on electrical resistance, however, and tensile strength and elongation generally furnished better criteria of conductor deterioration than either distribution and depth of pitting or loss of weight. Electrical measurements were chiefly useful in detecting lack of purity in the aluminium and in assessing reduction in current-carrying capacity.

Test samples were nearly all taken from 132 kV lines with 0·175 sq in conductors and 0·07 sq in earth wires which formed about three-quarters of the line mileage of the grid. Generally only conductors with a single layer of aluminium strands, e.g. earth wires, had a bitumen coating on the steel core. All steel strands were galvanized.

Results of Investigations

The experiments described were carried out in two periods, i.e. from 1934 to 1949 and from 1949 to 1952 and the more recent ones were analysed in detail. The mechanism of corrosion was considered in the light of differences between manifestations in industrial and coastal areas. Attacks on the outer surface of conductors in industrial centres were found to be due to the combined effects of sulphur oxides, moisture and soluble and insoluble fractions of solid pollution from industrial chimneys, sometimes with the addition of carbon, heavy-metal dusts and soluble matter. Carbon assisted corrosion by adsorbing sulphur oxides and concentrating them at the surface of the metal or by forming the cathode of an electrolytic cell of which the aluminium provided the anode.

Pitting between aluminium strands of lines near the coast was probably due to more severe corrosion taking place within crevices which retained moisture. This process would be facilitated where salt spray penetrated the conductor, the high concentration of chloride ions leading to breakdown of protective films on the aluminium. Bulge formation appeared to be due largely to contact between the aluminium (anode) and the galvanized-steel core (cathode) in the presence of an electrolyte. The aluminium then corroded, the steel not being attacked. The resulting hydrated aluminium oxide was deposited between the strands, retaining the electrolyte and forcing the strands further apart, thus permitting the ingress of more electrolyte. Earth wires having a steel core protected by bitumen were prone to this trouble if the bitumen cracked, since a small anode of zinc was exposed to a large cathode of aluminium. With steel-cored copper conductors, however, the steel was attacked, its potential being negative to that of copper. Their use had been largely discontinued (even in rural districts) owing to liability to breakage of the steel cores.

Discharge Lamp Dimming

Recent Advances in the Application of Gas-Filled Relay Valves

By C. E. WILLIAMS, B.Sc., A.Inst.P.*

A NUMBER of papers have been published dealing with apparatus for controlling the luminous output of hot cathode fluorescent lamps by means of gas-filled relay valves.† It will therefore be necessary to provide only a brief description of general principles in the present article.

The main control unit incorporates a pair of thyratron valves connected in reverse parallel as shown in Fig. 1. Although a single valve will only conduct electrons from cathode to anode, the combination will allow a.c. to flow if alternate valves are rendered conducting in succeeding half-cycles. The valves are connected in series with the load and the brightness of the lamps is varied by altering the period during each half-cycle when the valves are conducting. Thus, a very dim light is obtained if the ignition of the valves is delayed to a very late point in the half-cycle of supply voltage, as represented in Fig. 2a. Earlier firing of the valves produces greater output of light, successive stages being shown in Figs. 2b and 2c. In these diagrams a tungsten lamp load is considered.

If hot cathode lamps are used, each lamp is provided with a series choke and a filament heating transformer, the latter being supplied from a separate fixed voltage source. With this inductive arrangement the rise of current takes place at a finite rate after the ignition of the valves and, moreover, the current will continue to flow even after the mains voltage has passed through zero, due to the tendency of the chokes to oppose current changes. The relevant valve will ultimately be extinguished when the current falls to zero. These facts are illustrated in Fig. 3.

The superiority of this method of dimming discharge lamps over those involving a reduction of the effective supply voltage by potentiometer, variable transformer or common series impedance lies in the fact that a transient voltage wave is available for cyclically initiating the discharge in the fluorescent lamp. Thus before the lamp has become ionized the circuit consisting of the ballast choke and the stray capacitance in parallel with the discharge path is stimulated into damped relatively high frequency oscillation by the steep wavefront of voltage resulting from the ignition of the thyratrons. Since the damping is small the instantaneous voltage across the lamp will rise to a value nearly twice the available instantaneous supply voltage. This results in satisfactory lamp starting, even when the r.m.s. voltage applied across the choke and lamp is very low.

This transient action makes it possible for many lamp circuits to be operated in parallel from a single control unit, a feature of great practical importance, and otherwise difficult to achieve. Nevertheless, while starting and cyclic restarting problems are eased, another feature may yet prove to be a serious limitation. When a lamp is dimmed, its impedance increases very considerably due to the reduction in current and the accompanying increase in lamp voltage. The ratio of the stabilizing choke impedance to the lamp impedance is consequently reduced and variations from lamp to lamp become more important. A good standard of uniformity of lamp characteristics is

* Research Laboratories, General Electric Co., Ltd., Wembley.

† See, for example, Hess, K. W.; de Jong, F. M., "Controlling the Luminous Intensity of Fluorescent Lamps with the Aid of Relay Valves," *Philips Technical Review*, **12**, pp. 83–93, September, 1950.

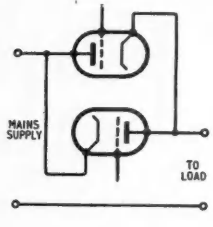
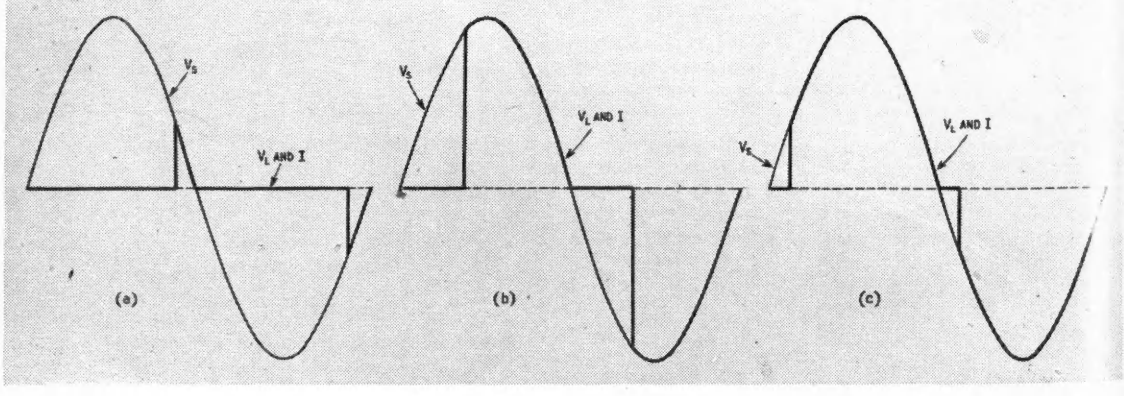


Fig. 1.—Simplified diagram illustrating the method of connection of the valves

Fig. 2.—Current and voltage waveforms with a resistive load, showing successive stages of increasing output. V_S = supply voltage, V = load voltage, I = valve and load current. The scale is adjusted so that the V_L and I waveforms are coincident



required to minimize differences in brightness of a group of lamps when dimmed in this way.

It may be noted that examination of the lamp voltage wave will not usually reveal an abnormally high peak of voltage at the ignition point. This is because of the heavy damping of the oscillatory circuit which occurs as soon as the lamp has become conducting.

Improved Arrangements for Lamp Starting

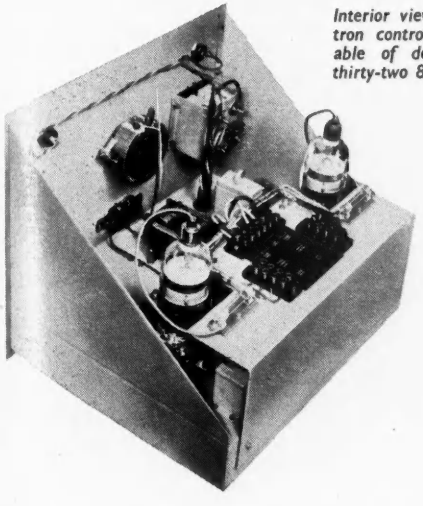
The detailed study of the waveforms occurring in operation has resulted in various improvements being made. It is apparent that although lamp restarting is assisted by the voltage doubling effect attributable to transient oscillation, a point must be reached at which even the doubled voltage is inadequate. For this reason abrupt extinction of the lamp takes place when the lamp current has fallen to about 0·02 of its normal value. The reverse phenomenon occurs when the lamp is being taken from the dim to the bright condition, and is usually more marked, since there is no residual ionization within the lamp. As is well known, the initial starting voltage of the lamp is greater than the cyclic restarting voltage.

This difficulty has been largely overcome by introducing lamp circuit elements which respond to the steep-fronted voltage wave supplied by the thyratron unit and are connected in such a manner that their oscillatory voltage is stepped up by transformer action. In Fig. 4 the capacitor C, the resistor R and the minor part of the winding of the tapped choke constitute an oscillatory circuit. The voltage appearing across the inductive element is magnified by the turns ratio of the tapped choke and is applied to the lamp, producing very satisfactory starting even at the lowest lamp currents.

Power Factor

Another way in which the performance of the equipment has been improved is by correction of the circuit power factor. This is not a simple matter since the connection of power factor capacitors directly in parallel with the load would result in damage to the valves. This would arise from the very heavy surges of current which would flow because of the sudden change of capacitor voltage consequent upon the ignition of the thyratrons.

These destructive current surges have been avoided by incorporating a small inductance in series with each power factor correction capacitor. By suitable choice of inductance the current surges can be limited so that they are within the peak current rating of the valves being used.



Interior view of thyratron control unit capable of dealing with thirty-two 80 W lamps

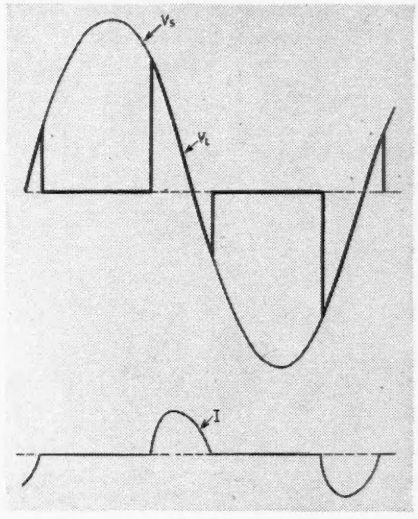


Fig. 3.—Current and voltage waveforms with an inductive load such as a choke ballasted fluorescent lamp

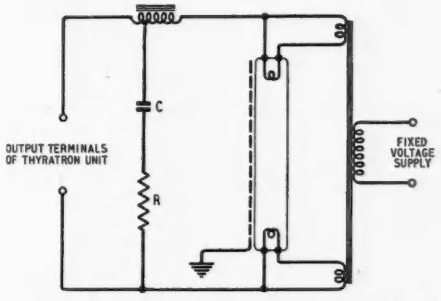


Fig. 4.—Circuit for improved lamp starting, depending on transient oscillations

In this manner power factors quite close to unity can be obtained. Advantages arise from this in several ways. Most obviously, an increase in the load capacity of a given control unit results, since the maximum permissible load is governed by the current and not by the voltage.

Another method of obtaining the same result consists of the well known twin tube circuit in which one lamp of a pair is controlled inductively and the other capacitively. Suitably modified filament heating arrangements and proper circuits for transient restarting are required. In this arrangement a choke is normally in series with the capacitor in the " leading " arm of the circuit, so that there is no need for any additional component for surge current suppression. Satisfactory co-ordination of the lumen output of the two lamps is obtained, and this is in a large measure dependent upon the correct functioning of the transient restarting circuit.

Mixed Load Operation

It is possible to use the thyratron control unit for dimming cold cathode or tungsten filament lamps, the general operating principles being very similar to those for hot cathode fluorescent lamps. Special arrangements for starting cold cathode lamps appear to be unnecessary and standard leakage transformer units may be connected directly to the thyratron output.

If no power factor correction arrangements are provided

it is necessary to use thyratron equipments individually adjusted for working into a specific type of load, since the required range of variation of thyratron ignition angle will be found to differ according to the load power factor and waveform.

An important advantage of the developments described in this article is that the limits of variation of the thyratron ignition and extinction angles may be made virtually coincident for all types of load, including hot cathode, cold cathode and tungsten lamps. This enables a single control unit to be used equally effectively with any of these types of load or with a combination of them.

Spurious Valve Firing

Another important improvement which has been made is concerned with measures for the suppression of undesired valve ignition. Some control units of early design were limited in application by such spurious valve firing, which was associated with an asymmetrical waveform and a low-frequency flicker of the lamps in some parts of the dimming range. Upon investigation it was found that this could be attributed to coupling between the valve grid and anode circuits. With certain load circuits the abrupt changes of voltage produced by the extinction of one valve were giving rise to grid voltage surges on the other valve, which were sufficient to cause premature ignition. The use of suitable filter circuits greatly reduces this tendency and widens the range of application of the control unit.

The flexibility of the gas-filled relay control unit described above is due to its ability to deal with loads of widely differing magnitude and type. This ensures a wide range of possible applications. In addition to conventional dimming involving lamps of one type and colour there is clearly scope for enterprise in application, for example, to such installations as those involving indirect cold cathode cornice lighting with additional tungsten lamps as focal points of visual interest.

Trial Installations

Other possibilities are opened up in the field of motor operated continuously changing colour floodlighting schemes. Successful trial installations of this type have been carried out, using a system of relays to connect a single control unit successively to any one of three circuits comprising 80 W hot cathode lamps of different colours. By using direct connection to the mains to obtain an overlap of colours, a continuously changing illumination is obtained.

Another interesting trial installation is in use for shop window lighting. In this application the ability of the control unit to handle different types of load is exploited by utilizing coloured hot cathode lamps for overall and background lighting, a number of spotlights directed upon various central display pieces being raised to full brightness in succession. In this way the objects displayed are given prominence by highlighting, the rather flat effect of the overall lighting is enlivened and an opportunity is presented of viewing the goods in their " natural " colours.

Steam Turbines for High Temperatures

The Thomas Lowe Gray Lecture

THE twenty-sixth Thomas Lowe Gray Lecture was delivered by Dr. T. W. F. Brown (Director, Parsons and Marine Engineering Turbine Research and Development Association) on 15th January at the Institution of Mechanical Engineers. Its title was " High-temperature Turbine Machinery for Marine Propulsion," but in view of the restricted scope imposed by sea conditions examples were mainly derived from electricity generating stations on land.

The highest steam conditions in British ships, he said, were 625 lb/sq in and 950 deg F in three Alfred Holt vessels using 8,000 s.h.p. (Metropolitan-Vickers). The upper limit was about 60,000 h.p. per shaft, but 10,000 h.p. was the usual figure, whereas for land installations units up to the equivalent of 290,000 s.h.p. (217 MW) had been constructed, the size of which enabled higher pressures to be employed without large leakage losses at the high pressure end of the turbines.

Examples of British Plant

Constructional particulars of typical high temperature sets by British manufacturers were given. The British Thomson-Houston Co., which built a 10 MW (1,000 deg F) machine for Detroit, was now constructing a two-cylinder impulse tandem-compound double-flow 60 MW turbine with double casing for Meaford power station for steam conditions of 1,500 lb/sq in and 1,050 deg F with six feed-heating stages. Sets of the same rating by C. A. Parsons for steam conditions of 900 lb/sq in and 925 deg F had three cylinders and reaction blading throughout. Heat rate was 9,200 B.Th.U./kWh and steam flow 8·4 lb/kWh. Machines of 125 MW were under construction for 1,500 lb/sq in and 1,000 deg F with reheat to give a heat rate estimated at 8,200 B.Th.U./kWh.

The English Electric Co.'s designs for 1,500 lb/sq in and 1,050 deg F included 100 and 60 MW units with six stages of feed heating giving heat rates of 8,463 and 8,788 B.Th.U./kWh respectively. The high pressure cylinders had a double casing with a single Curtis wheel followed by single-row impulse stages. The 60 MW would be the first to operate at this temperature in Britain. Fraser & Chalmers had developed designs for 1,500 lb/sq in and 1,050 deg F with reheat up to 1,000 deg. Notable among the many Metro-Vick productions was the 100 MW two-cylinder impulse double-casing turbine for Castle Donington with steam conditions of 1,500 lb/sq in and 1,050 deg F. A design for 120 MW with similar steam conditions but with reheat to 1,000 deg had also been developed.

In the United States the highest inlet temperature of any machine designed at present was 1,150 deg F for a 125 MW set to operate at the super-critical pressure of 4,500 lb/sq in (Philo power station) where the overall

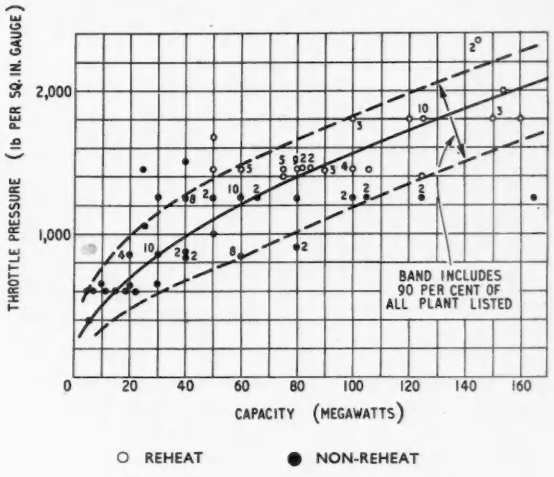
thermal efficiency was expected to be above 40 per cent. Two stages of reheating—to 1,050 deg and again to 1,000 deg—would be employed. A 185 MW unit for 2,350 lb/sq in and 1,100 deg F reheated to 1,050 deg was on order for Burlington power station. Several turbines had been designed for pressures up to 2,350 lb/sq in, 1,800 lb being a preferred standard. On the Continent of Europe large machines built or being built included 125 MW sets in France with steam conditions of 1,500 and 1,800 lb/sq in and 1,000 deg F, reheated to initial temperature. In Switzerland 100 and 150 MW turbo-alternators had been designed to operate at 1,550 lb and 977 deg; the estimated heat rate for the larger was 8,500 B.Th.U./kWh.

Highest Practicable Temperatures

Materials had been tested on a laboratory scale up to 1,800 deg F, as shown in an appendix, but a top metal temperature of 1,700 deg in the superheater tubes with steam leaving at 1,500 deg was the best that could be expected at present. The highest temperature of steam impinging on the blading and surface of the rotor would be 1,400 deg, which would give not more than 1,350 deg at the rotor bore below the first stage disc. By using the stresses available at the appropriate temperatures shown in the appendix, a practicable turbine could be produced.

The relationship between steam and gas turbines was emphasized. The high temperature gas turbine would be a lighter installation possessing inherently better thermal efficiencies. The fundamental difference between the steam-cycle and the open-cycle gas turbine was one of heat transfer through superheater tubes (which limited the temperature to what these could stand) as against the direct generation of heat in the working fluid. However, the weight of portion of superheaters and piping and high pressure turbine which were subjected to very high temperatures was only about 2 per cent of the total.

Appendices included, in addition to the creep data mentioned above, a method of determining the heat rate for a 60 MW turbo-generator with initial steam conditions of 1,500 lb/sq in and 1,500 deg F, with two stages of reheat up to 1,500 deg and a vacuum of 28·5in Hg, and extensive references to sources of information on high temperature equipment.



Steam pressures associated with rated capacities of turbo-alternators. The numbers on the graph show the numbers of installations

ESTIMATED EFFICIENCIES OF 60 MW TURBINES

Steam conditions		Turbine thermal efficiency (gross) per cent	Auxiliary power per cent	Boiler efficiency per cent	Overall efficiency (net) per cent
Lb/sq in gauge	Temperature deg F				
600	850	35·2	4·1	88	29·7
600	850 (reheat)	37·1	4·1	88	31·3
1,500	1,200	41·6	4·6	88	35·0
1,500	1,200 (reheat)	43·2	4·6	88	36·4
1,500	1,200 (2 reheats)	44·7	4·6	88	37·7
1,500	1,500	44·0	4·0	88	37·3
1,500	1,500 (reheat)	45·8	4·0	88	38·7
1,500	1,500 (2 reheats)	47·3	4·0	88	40·0

TURBINE HEAT RATES FOR POWER STATIONS

Station	Manufacturer	Steam conditions			Stages of feed heating	Feed temperature deg F	Capacity MW	Heat rate at most economic rating B.Th.U./kWh
		Lb per sq in gauge	Temperature deg F	Inches of mercury				
				Non-reheat plants				
—	Parsons	900	925	—	—	—	60	9,200
—	English Electric	900	900	28·7	5	385	60	9,224
—	English Electric	1,250	950	28·86	5	460	60	9,042
—	English Electric	1,500	1,050	28·9	6	410	100	8,463
Willesden	(1) Metropolitan-Vickers (2) English Electric	1,300	950	28·7	6	360	30	(1) 9,287 } mean 9,295 (2) 9,302 }
Essex No. 1	American G.E.C.	1,250	1,000	28·5	8		100	8,500
Sewaren Nos. 2 and 3..	American G.E.C.	1,500	1,050	28·5	8	453	100	8,250
Dampf Kraftwerk Weisweiler, Aachen ..	Brown, Boveri	1,550	977	28·25	6	415	150	8,500
				Single-stage reheat plants				
—	Parsons	1,500	1,000/1,000	—			100	8,200
Dunston "B II" ..	Parsons	600	850/850	28·75	4	346	50	9,460
Brimsdown "A" ..	Metropolitan-Vickers	1,900	930/810	28·7	5	355	53	9,407
Philip Sporn	American G.E.C.	2,000	1,050/1,000	28·5	8	441	141	* { Net 9,270 { Gross 7,820
				Two-stage reheat plant				
Philo	American G.E.C.	4,500	1,100/1,050/1,000	29	7	515	120	*Net 8,200

* "Gross" refers to turbines only and "net" to the overall figure including boiler efficiency and auxiliaries.

Wool Textile Industry

THE discussion on the paper entitled " Electricity in the Wool-Textile Industry," which was summarized last week in the *Electrical Review*, was opened by Mr. F. W. Cox (Metro-Vick), who said that in the wool textile industry considerable use was still made of private plant, which could be just as economical as the public supply. He disagreed with the authors' statement that allowance must be made in motor ratings for temperature conditions. Most motors were rated for an ambient temperature of 40 deg C, which was above the average in most mills, and the comparatively low demand factor was probably due to over-motoring rather than to de-rating for ambient temperature. Totally-enclosed motors, which the authors recommended for dyeing and finishing sections, would tend to breathe in moisture in a heavily-saturated atmosphere and, unless drainage holes were provided, might give trouble through internal condensation.

In woollen mills 95 per cent of the spinning was carried out on mules, and the motors must have adequate pull-out torque to drive them and meet the peak condition as they pulled out. High-torque motors with level characteristics had not proved very satisfactory. For carding machines, the characteristic resistance torque of the machine was approximately constant with a given material, but could vary considerably with the type of material.

Distribution tended to follow conventional lines, but in the larger factories the layouts lent themselves to ring mains, and he had also been able to use the T-system and overhead busbars.

Mr. E. V. Giles (Hunt & Winterbottom), speaking as one engaged in the wool textile industry, emphasized the need for versatility, which might be adversely affected by " automaticity." While the back-pressure method of heating was sometimes efficient, much depended on the type of heating load. A dye-house, for instance, had a very peaky load. He inclined to the view that the most economic method was to buy power from the public supply and to generate heat and transmit it as high-pressure hot water.

He believed that group drives still had a place. With certain machines such as the mule the operations were intermittent and the demands on the motor very peaky, so that it was more efficient to have one motor of suitable size driving four machines. That also applied to some extent to looms. There must be enough power to get the loom going rapidly, so that the shuttle went right across.

They had had in a dye-house the trouble to which Mr. Cox referred with totally-enclosed motors, and had found that a well-insulated drip-proof motor gave less trouble.

Variable speeds were invaluable in certain cases. The Ward-Leonard drive was good if one could afford it. The commutator a.c. motor was a satisfactory machine, but it was often not possible to start off on full speed, and at low speed the torque was poor. D.c. motors with a wide speed range, supplied from a mercury arc rectifier, worked very well.

Mr. F. T. Bartho (Crompton-Parkinson) said that they were often asked to de-rate motors because of high ambient temperature, but this was rarely necessary, since B.S. 168 was based on a 40 deg C temperature rise, and he knew of no textile mill in which the ambient temperature approached that figure.

In cases such as a mule drive, where the motor must have a high pull-out torque and the load varied widely, it was difficult to get a true estimate of the r.m.s. duty cycle, and it was useful when the motor was running to check the temperature by a thermometer. If the motor had adequate pull-out torque, a safe temperature gave a good indication of its suitability.

He would prefer to standardize on totally-enclosed fan-cooled motors rather than leave it to individual judgment to decide whether the " fly " was excessive; the " fly " could easily be removed. There was something to be said for putting drain holes in the bottom of the motor. To draw clean air into a motor with pipe ventilation was difficult, and with single-pipe ventilation chimney effect caused trouble when the motor cooled down.

With these drives the starting torque was often relatively small but a very high accelerating torque was needed. With squirrel-cage motors the starting time was important to avoid overheating. With a totally-enclosed motor, at the end of the starting period heat would radiate from the rotor and raise the temperature of the stator winding.

Mr. S. D. B. Percival (B.T.H.) said that the bulk of the drives in the wool textile industry had fortunately been done by general-purpose motors and control gear. The drives gave plenty of scope for the new B.S. motor, the most suitable being the totally-enclosed fan-cooled motor having a single skin and surface cooling, with no ducts to become clogged.

For ring spin drives the use of a variable-speed motor with special automatic regulator provided one solution, but a second approach was to use a two-speed motor or a two-motor drive—the lower speed for the first part of the drive and the higher (perhaps 7 to 10 per cent higher) for the main body of the cop.

Appointment of I.E.E. Committee Suggested

Mr. G. H. Brook (Brook Motors) said that worsted spinning frames driven by variable-speed motors and spinning regulators might appear an improvement on frames driven by induction motors with a flat accelerating torque curve, but the cost of conversion could be £600 per frame. Tandem motor drives gave almost the same production increase at one-sixth the installation cost.

Synchronized carding setts were now in operation with separate motors for each revolving drum. New machines for carpet yarns had six slip-ring motors of from 2 to 6 h.p., all working in synchronism. In one case production had increased from 80 to 110 lb of wool per hour. Individual driving of mules by high-slip induction motors was now standard practice. He suggested the appointment of a committee by the Institution to see how Britain's oldest industry could be helped by Britain's newest.

Mr. L. Landon Goodman emphasized that in many mills only process integration could provide proper instrumentation and control. A small servo mechanism taking a few watts could put many kilowatts at the worker's elbow. Lighting should be built into process machines.

Mr. B. C. Robinson suggested the use, in small mills or in particular processes, of back-pressure engines driving asynchronous generators. In the nylon industry spindle speed and power had by no means a linear relationship; the horse-power went up much more steeply with spindle speed. Where there was 10 h.p. or over per 6ft in a line the overhead busbar system was worth while.

Mr. A. J. Francis in replying to the discussion, remarked that an obstacle to the use of electronic devices was the lack of technical personnel. Possibly the Institution could do something to provide the necessary technicians.

Mechanical Handling

Extension of Lansing Bagnall Works

ON Thursday last week a large extension of the Basingstoke (Hants) works of Lansing Bagnall, Ltd., was officially opened by General Sir Ouvry L. Roberts, G.C.B., K.B.E., D.S.O., M.A., Quartermaster General to the Forces, in the presence of about 200 visitors, including representatives of the Services, Government Departments, the Dominions and industry. At the ceremony Sir Ouvry Roberts was introduced by Mr. John R. Sharp, managing director of the company, and after declaring the extension open "unveiled" three of the company's new products which with others were later demonstrated.

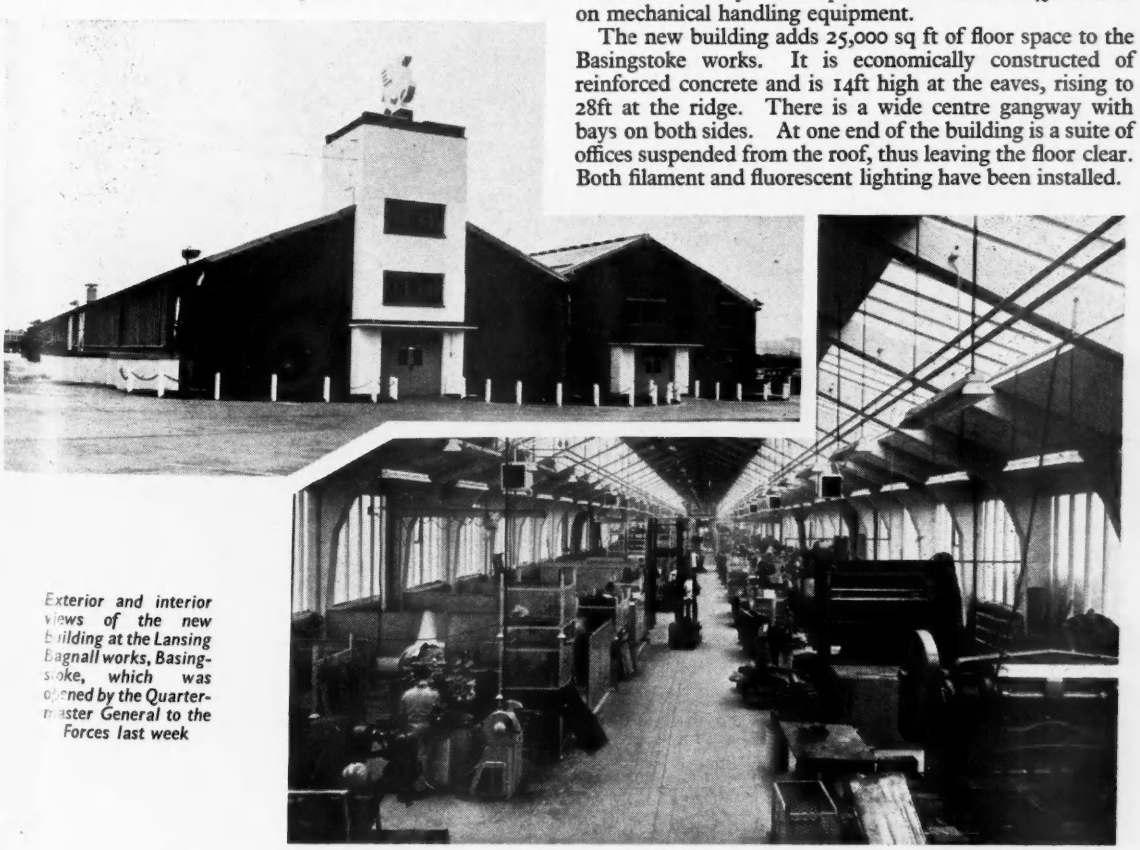
A tour of the new shop followed when the party was able to watch various processes in the building of many types of mechanical handling equipment, including the pressing of sheet, welding and cutting, machining, assembly and test. There followed a half-hour's demonstration of about twenty examples of the company's products—fork lift trucks, pallet trucks, power stillage trucks, tractors and trailers—electrically and petrol-engine operated.

All the electrically-operated trucks incorporate the company's special traction circuit which gives smooth starting, easy twist-grip control and regenerative braking. A convenient feature is the built-in battery charger and the batteries are so housed as to facilitate changing when the vehicle is in constant use. The pallet trucks are made in a number of types for special purposes and for loads up to 6,000 lb. Fork lift trucks are made for a single lift of 5ft 7in or with a telescopic lift of 10ft 10in and for loads of from 1,000 lb to 1 ton.

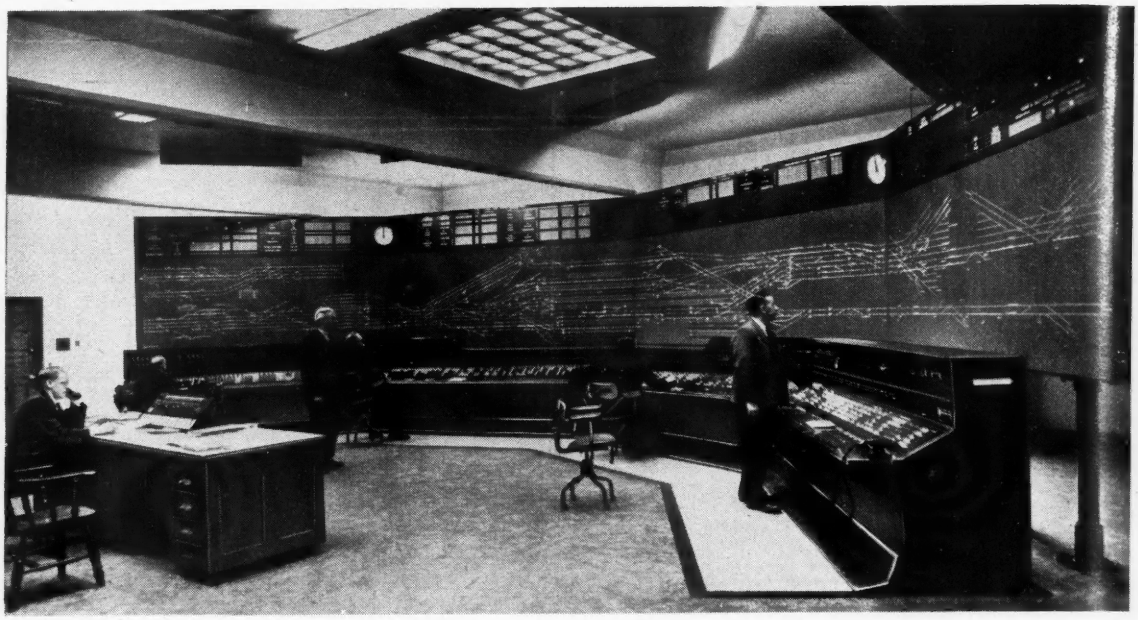
At a subsequent luncheon, served in an annexe to the new building, Mr. Sharp proposed the health of the guests and in doing so referred to the company's rapid progress in the past few years. He mentioned that the extension had been built in five months and he paid a tribute to the licensing authorities, the architects and contractors. The company now claimed to offer a greater range of material handling vehicles than any other manufacturer in Europe.

In the course of replying to the toast, Sir Ouvry Roberts thanked the company and industry generally for the great assistance they were giving the Forces in connection with rearmament. It was his policy to order as far as possible equipment which was already in use in industry; that applied particularly to mechanical handling appliances, although sometimes he had to seek the help of manufacturers in the modification of their designs for military purposes. The R.A.O.C. and R.E.M.E. were short of labour and mechanical aids were essential to them. General Roberts concluded by saying that during the next twelve months the Army would spend not far short of £2 million on mechanical handling equipment.

The new building adds 25,000 sq ft of floor space to the Basingstoke works. It is economically constructed of reinforced concrete and is 14ft high at the eaves, rising to 28ft at the ridge. There is a wide centre gangway with bays on both sides. At one end of the building is a suite of offices suspended from the roof, thus leaving the floor clear. Both filament and fluorescent lighting have been installed.



Exterior and interior views of the new building at the Lansing Bagnall works, Basingstoke, which was opened by the Quartermaster General to the Forces last week



The route interlocking installation at York illustrated above is the largest in the world. Brought into service in 1951, it has 825 route switches mounted on a separate console standing several feet in front of the illuminated diagram

Railway Signalling

Modern Methods Reviewed

In a paper read before the Association of Supervising Electrical Engineers on 19th January, Mr. J. P. Coley described the signalling methods in use on British railways, which have as their primary object the securing of a safe interval between trains. Semaphore signals controlled on the manual block system, he stated, were the most usual on British railways, but for high traffic densities with short sections this system became costly and impracticable because of loss of time in bell signals and lever operations. These difficulties could be overcome by the use of automatic colour-light signalling.

The basis of modern signalling was the track circuit, formed by electrically insulating sections of the running rails. At one end of a section were a battery and adjustable resistance which energized a relay connected across the rails at the other end. The wheels and axles of a train entering the insulated section short-circuited the relay, thus releasing the signal to show red. Any failure of the system would act similarly. Track circuits varied in length, about one mile being the maximum. A.c. track circuits were also used, particularly where d.c. was employed for propulsion. The a.c. relays were similar in principle to the d.c., but the operating movement comprised an aluminium vane moving in an air gap in an iron circuit with two magnetic fields, which required a phase displacement of up to 90 deg to cause the relay to function. One winding was connected to the 110 V signal main and the other to the track circuit.

Although semaphore arms were frequently operated by electric motors, the colour-light signal, introduced after the first world war, was by far the most popular. The spacing of the three aspects—red, yellow and green—was preferably the braking distance of the fastest train on the line. For the shorter distances in suburban areas, four-aspect signalling with two yellow lights, one above the other, was provided to show high speed trains where they should start braking to draw up at a stop signal ahead; a local train would proceed at normal speed until reaching a single yellow light.

Power operation of a point layout usually took the form of an electric motor drive or an electrically controlled compressed air drive. Voltages higher than 110 were rarely used for railway signalling circuits. Other matters discussed included the interlocking of points and signals and their control circuits, automatic train control and audible cab signalling.

Torquay Convention Proceedings

THE proceedings of the fifth British Electrical Power Convention held at Torquay last June have now been published in book form. The contents include Sir John Hacking's presidential address; the nine papers which were presented with the discussions (including written contributions); reports of the "Electrical Forum" and annual dinner speeches; the accounts; and a list of delegates and visitors. Copies (12s 6d each including postage) can be obtained from the Secretary, British Electrical Power Convention, Winsley Street, London, W.1.

VIEWS on the NEWS

By REFLECTOR

BECAUSE of the strike of electricians at Olympia last week no microphone was available at the opening of the Hotel and Catering Exhibition. Consequently Mr. H. G. Strauss, Parliamentary Secretary to the Board of Trade, had to defer his speech until the luncheon which had been arranged to follow the ceremony. It ill becomes an electrical man to criticize a politician for regarding a microphone as essential, but I recall the days when the unaided human voice was considered sufficient on such occasions. I admit, of course, that the microphone enables wider audiences to be reached but this is not always a boon and a blessing. Everything depends upon the speaker's matter and manner.

* * *

At the time of writing it looks to me as though the leaders of the Electrical Trades Union have over-reached themselves and now find that they have got into a position from which it will be difficult to escape without " loss of face." Although they report the wholehearted co-operation of their members there are indications that many of these members are more than a little doubtful of their leaders' tactics. The National Federated Electrical Association, having lived down its unwise one-day lock-out, has adopted a reasonable attitude in placing its reliance in some form of arbitration, which, in spite of the present stand of the E.T.U., must eventually be resorted to. Everybody concerned is thoroughly tired of the whole foolish business and will be glad when some independent agency steps in to get the two sides to the dispute out of the mess they have got themselves into.

* * *

Recent letters to *The Times* have called attention to the poor quality of some electrical appliances. Rather sweeping condemnation has been expressed, making it appear as though nearly all of the equipment was of inferior character. It is unfortunately true that a number of inexperienced or get-rich-quick concerns have crashed into the business and put on the market appliances that are not only unsatisfactory but even dangerous. Some of the older apparatus made by the more reputable concerns was produced at a time when materials were short and the substitutes used have not stood up to service so well. Generally speaking, however, the electrical domestic equipment made by sound manufacturers is fit for its work. The E.D.A. Testing House at Leatherhead will increasingly help to eliminate inferior appliances or at least induce their producers to make the necessary improvements. But it has also to be said that users are not free from blame. Some people consistently ill-use their appliances and complain when these appliances are put out of action by treatment which almost amounts to cruelty.

* * *

Sixty years ago electricity supply was really in its infancy although the phrase is still occasionally used at the present day. Lighting was then the principal application and in this sphere electricity naturally came hard up against gas. An extraordinary effort to overcome this difficulty was made by the Lyons Electrical Power Storage Co., Ltd. (as reported in the *Electrical Review* of 26th January, 1884). This company increased its capital, one object of the increase being to pay 12,000 fr. and to issue 400 fully paid shares to the representatives of the Syndicate Stephanois du Gaz " in consideration of the dissolution of such syndicate, which is deemed to be an obstacle to the establishment of the company." A somewhat expensive way of eliminating competition.

In the same issue, the chairman of the Electric " Sun " Lamp & Power Co., Ltd., is reported to have contended that it was desirable to have " a small number of directors who should be, if possible, practical electricians." A shareholder at the meeting said there was not the slightest doubt that another five or ten years would pass before electric light companies would be made to pay, " the cost of keeping up steam engines, etc., being about five times as much as there was any possible chance of making by profit."

* * *

A few weeks ago I made mention of a humorous drawing in an Electricity Board magazine in which curves exhibited on an office wall showed rising tendencies in relation to " Red tape consumed " and " Man-hours wasted " while a " Units consumed " curve was drooping. It can now be revealed (as the newspapers say) that the magazine was *Contact* (Merseyside and North Wales Electricity Board). The Editor accuses me of lack of a sense of humour but I can assure him that it was an excess of this commodity which inspired what was merely a " leg-pull." I did not think that anybody would really be worried by these " spoof " graphs, but it is a lesson to me not to be funny about funny things.

* * *

It has become common form for Electricity Consultative Councils to assure consumers that, contrary to their belief, they (the Councils) are not merely " rubber stamps " for their respective Electricity Boards. The Midlands Consultative Council goes farther than this. At a recent meeting in Birmingham a member stated that the Council had fought the Board to secure the alteration of a tariff and said:—" It was two years' hard work and they only gave way at the point of the bayonet." As if this military method was not enough, another member averred:—" We have shown that if we are a rubber stamp we can bite and scratch as well as bark." This, if I may say so, is not only very ungentlemanly but peculiar behaviour for a rubber stamp.

* * *

A note in the *Recorder Weekly* refers to the publication by the Aden Government of a five-year development plan. It says:—

> " The plan, to end in 1958, includes the construction of a 570-bed modern kilowatt electric power house, . . ."

This should solve the difficulty of finding accommodation for the power station staff.

PERSONAL AND SOCIAL

News of Men and Women of the Industry

THE British Electricity Authority has appointed **Mr. T. L. Irving** as operation engineer at Carlisle for the North Western Division.

Mr. Oliver Thomas, manager of the Materials Handling Department of the Fraser & Chalmers Engineering Works of the G.E.C., retired on 31st December after nearly fifty-two years' service with the company. Mr. Thomas joined Fraser & Chalmers, Ltd., as the company was then known, in 1902, and after a period in the machine shops and other departments of the company, was appointed manager of the Estimating Department of the Materials Handling Department. He early became associated with Mr. R. K. Stockwell, the European manager of Robins, Inc., of the U.S.A., with whom Fraser & Chalmers had licence agreements to manufacture materials handling equipment to their design. Under Mr.

Mr. O. Thomas

Thomas' guidance the two companies pioneered materials handling equipment. During 1940, on the death of Mr. W. S. Edwards, Mr. Thomas took over the general management of the Materials Handling Department. At the conclusion of the war Mr. Thomas was a member of the Allied Commission in occupied territories which investigated German materials handling and treatment plants. **Mr. B. S. Pelton,** B.Sc., A.M.I.E.E., takes over the position relinquished by Mr. Thomas.

Mr. H. T. Timberlake, A.M.I.E.E., has been appointed district manager at West Bromwich, North Staffs and South Worcs Sub-Area, Midlands Electricity Board, and will be taking up his appointment there early in February. His present position is commercial engineer, South West Fylde District, North Western Electricity Board. Mr. Timberlake commenced his career with the Belfast Corporation Electricity Department, and he later served with the Bangor Corporation and the Electricity Board for Northern Ireland. In 1937 he was appointed engineer and manager of the Brentwood Electric Supply Co., Ltd., Essex, and in 1945 deputy borough electrical engineer and manager at Harrogate, where he remained until taking up his present position in 1950.

Mr. C. Acourt, power station superintendent with the Jersey Electricity Co., Ltd., has been appointed assistant manager (production). Mr. Acourt served his apprenticeship with the railway company formerly on the Island. He joined the Jersey Electricity Co. in charge of its first generating station when it started up in 1926.

Mr. C. S. Furbank has now joined the Northampton Machinery Co., Ltd., and has been appointed works manager.

Mr. H. L. Wickes, A.M.I.E.E., has been appointed sales specialist (motors) with the Brush Electrical Engineering Co., Ltd., operating from the Loughborough works. Mr. Wickes, who was previously sales manager of Higgs Motors, Ltd., Birmingham, will take up his duties on 1st February.

To mark the twenty-first anniversary of the founding of Nettle Accessories, Ltd., a subsidiary of Aerialite, Ltd., employees presented the Aerialite chairman, **Mr. Lawrence Hargreaves,** with a cigarette case. A similar presentation was made to **Mr. Frank Whittingham,** night foreman, who has worked for the firm for twenty-five years.

Mr. A. B. Owles, divisional chemist with the North Western Division of the B.E.A. in Manchester, is to retire at the beginning of March after forty-three years' service in the electricity supply industry.

Mr. Alan Parker, A.M.I.Mech.E., A.M.I.E.E., M.Inst.F., deputy station superintendent, Clarence Dock power station, has now been appointed superintendent of the Ince power station, near Ellesmere Port, Cheshire, of the Merseyside and North Wales Division, B.E.A., with effect from 1st February.

Mr. A. E. Underwood, executive director of the Plessey Co., Ltd., has been appointed a director of Plessey International, Ltd., the overseas sales organization for the products of the Plessey group of companies.

Mr. Anthony J. Beer has resigned from Santon, Ltd., and has been appointed to the technical sales staff of Falk, Stadelmann & Co., Ltd., at their head office, 91, Farringdon Road, London, E.C.1.

Mr. J. W. Barrow, A.M.I.P.E., has been appointed deputy general manager of the M.S.S. Recording Co., Ltd. Mr. Barrow was educated at Prescot Grammar School and St. Helens Technical College, Lancs. He served an apprenticeship with British Insulated Cables, and was later connected with the development of their meter, welding machine and moulding machine factories; in 1942 he was appointed works manager of the company's Cressex works at High Wycombe, at that time manufacturing aircraft components. After the war he became works manager of the United Insulator Co., Ltd. Since 1949 until his present appointment Mr. Barrow has been connected with the development of the overseas factories of British Insulated Callender's Cables, Ltd.

Sir Hamish MacLaren, K.B.E., Director of Electrical Engineering, Admiralty, is to receive the honorary degree of LL.D. from the University of St. Andrews on the occasion of the opening of the Ewing Building at Dundee on 12th February. This building is occupied by the Departments of Electrical Engineering and Botany.

Mr. J. M. G. Burgoyne has been appointed a director of Britannia Electric Lamp Works, Ltd., to fill the vacancy caused by the death of Mr. H. Ledward.

Mr. W. A. May has been appointed secretary of Berry's Electric, Ltd., and relinquishes his control of the Export Department.

Mr. L. G. Bettinson becomes export manager with effect from 1st February. Mr. Bettinson received his technical and commercial training with the Southend Corporation electricity undertaking with whom he remained until mobilization into the R.A.F. in August, 1939. As a squadron leader, in 1943, he was awarded the D.F.C. and, later, was appointed to a permanent commission. Mr. Bettinson resumed his commercial career with the Wessex Supply Co., Ltd., and later the Southern Electricity Board and then joined Berry's Electric, Ltd., as southern counties representative.

Mr. P. Earley has joined the company as southern counties representative.

Mr. L. G. Bettinson

Mr. P. Earley

He commenced his career with the Reading Electric Supply Co., Ltd., in 1929 and was in charge of the hired apparatus section of Reading Corporation Electricity Department from 1936 to 1939. In the last war he served in the R.A.S.C. and was in France, North Africa and Italy. He rejoined Reading Corporation as deputy to the showroom manager and was promoted in 1949 to take charge of the Reading district showrooms of the Southern Electricity Board.

Mr. John E. Chadbund, A.M.I.E.E., until recently assistant general manager of the Rochester works of Elliott Bros.

Mr. J. E. Chadbund

(London), Ltd., joined Simms Motor Units, Ltd., on 4th January as works manager. After graduating from Sheffield University with an engineering degree in 1935, Mr. Chadbund joined the English Electric Co., Ltd., as a graduate apprentice, and remained with that company in the position of process and development engineer. From 1941 to 1945 he was night superintendent of the Rugby works, which was concerned mainly with the production of steam and water turbines and diesel engines for the Navy. Mr. Chadbund joined the Brush Electrical Engineering Co., Ltd., in 1948 as assistant works manager, later becoming a divisional works manager.

Mr. R. G. Game has been appointed manager of the London office of the Express Lift Co., Ltd., in Greycoat Street, Westminster. Mr. Game, who has been with the company some thirty years, has previously held appointments in the Engineering Department and as a sales engineer.

Some 750 members and friends attended the annual New Year party and ball of **Marconi Instruments Social and Sports Club,** held in Watford Town Hall on 8th January. A feature of the evening's entertainment was the display by the Club's Ladies Keep Fit Section. Mr. J. M. Furnival, general manager of the company, presented to this section later in the evening the challenge trophy for the group making the most progress in the year.

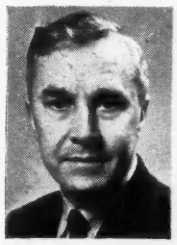
Mr. R. Harriman is joining the sales organization of Bulpitt & Sons, Ltd., Birmingham, on 1st March, and will be responsible for their West Country territory, where he at present holds an appointment as area manager for the Domestic Appliance Division of the English Electric Co., Ltd. He was previously a district commercial officer with the London Electricity Board and before nationalization held appointments with the electricity undertakings of the Bethnal Green, Battersea and Ilford Councils.

Sir Harold Saunders, F.C.G.I., B.Sc.(Eng.), will retire from the Monopolies and Restrictive Practices Commission at the end of this month on the expiration of his term of office. He was formerly Comptroller-General of the Patent Office.

Mr. W. J. Prior, A.M.I.E.E., has been appointed station superintendent at Keadby where he is at present deputy station superintendent. He takes up his new appointment on 1st February. Before going to Keadby Mr. Prior was operation engineer at Stockport and shift charge engineer at Stuart Street, Manchester, Mexborough and Barugh power stations.

Mr. C. G. White, general sales manager and director of Kelvin Hughes (Marine), Ltd., has been elected chairman of the Radio Communication and Electronic Engineering Association for 1954. Mr. White has been vice-chairman of the Association for the last two years and was president of the British Nautical Instruments Trades Association from 1949 to 1952.

The Backer Electric Co., Ltd., Rotherham, has appointed **Mr. S. Davis** as works manager. Mr. Davis has been works superintendent for a

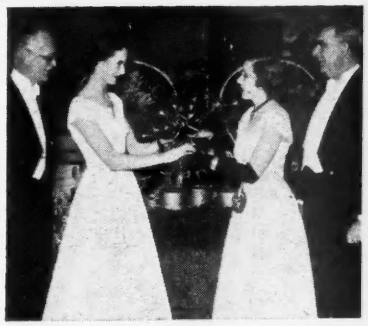


Mr. S. Davis

number of years, and has been connected with the company since it started its activities.

The Eutectic Welding Alloys Corporation of America has announced the prize winners of the 1953 competition for contributions to the science and art of non-fusion welding, brazing and soldering. The prizes are awarded to competitors throughout the world, and the second prize of $100 for practical welding applications has been awarded to **Mr. G. G. Musted,** of Birmingham. The award was presented to Mr. Musted at a recent luncheon at the Queen's Hotel, Birmingham, by Mr. K. F. Crayford, sales manager of the Eutectic Welding Co., Ltd., the British company.

The annual E.D.A. Carnival, on behalf of the **Electrical Industries Benevolent Association,** was held at the Oxford Galleries, Newcastle-on-Tyne, on 15th January. The 1,000 guests were



Left to right: Mr. A. Parkin, Miss Christine Parkin, Mrs. J. W. W. Mitchell (daughter-in-law of Mr. J. C. Mitchell), and Mr. J. C. Mitchell

received by Mr. J. C. Mitchell, chairman of the Northern Counties Area of the E.I.B.A., who was accompanied by his daughter-in-law, Mrs. J. W. W. Mitchell, and in the accompanying picture we show Miss Christine Parkin, daughter of Mr. A. Parkin, the Carnival organizer, presenting a bouquet to Mrs. Mitchell. Mr. Parkin tells us that as a result of last year's Carnival a sum of £480 was given to the E.I.B.A.

Mr. Edward Griffiths, who recently retired after thirty-five years as district engineer at Wednesbury, was on 15th January presented with a cheque by his former colleagues of the Midlands Electricity Board. The presentation was made by Mr. W. S. Lewis, chairman of the Board, at the first annual dinner of the Board's new combined Wednesbury and Bilston District.

Commander (E) A. H. Robinson, R.N.V.R. (Retd.), has been appointed London branch manager of Associated British Oil Engines (Marine), Ltd. Since 1949 he has travelled abroad extensively for the company on marine business, and has recently returned from the Far East and Australia.

The Electrical Association for Women announces that the Elizabeth Sloan Chesser Cup has been won by **Mrs. Edna Prophet,** of the North Western Electricity Board, Chorlton-on-Medlock, who gained the highest marks in 1953 among demonstrators taking the E.A.W. Diploma in Electrical Housecraft. The runner-up was **Miss Edna Petrie,** of the North of Scotland Hydro-Electric Board, Aberdeen. The Councillor Miss Walter Rosebowl has been won by the County Technical School for Girls, Tonbridge (the holders), and the South-East Essex Technical School, Dagenham.

The E.A.W. Cheltenham Branch marked its silver jubilee by offering an annual monetary award to be given to housewives who gained the highest marks in the home workers' examinations, the three awards, of £5, £3 and £2, to be used to buy some piece of electrical equipment. In 1953, the second year of the award, three members gained equal marks, and the

prize money was therefore divided equally among **Mrs. Elaine Borwick** of Perth, and **Mrs. Florence A. Fowler** and **Mrs. Ellen S. Hiam,** both of the Mid-Gloucestershire Branch.

Mr. Leonard H. Short, M.C., M.I.E.E., M.Inst.T., has been appointed general export manager of the English Electric Co., Ltd., in succession to **Mr. H. S. Aspinall,** who retired on 31st December, having held this appointment since 1937. Mr. Aspinall will remain a director of the English Electric Export & Trading Co. and will continue to serve the company on special duties in connection with its export affairs.

Mr. L. H. Short

After gaining a first-class diploma at Faraday House, Mr. Short joined the English Electric Co. at Preston as a pupil. He has held a number of important appointments, including resident engineer in charge of railway electrification in India, deputy manager and chief engineer of the Traction Department, and since 1951 he has been deputy general export manager. He is a director of the English Electric Export & Trading Co. and has travelled extensively in most parts of the world.

Among other activities, Mr. Short has just completed two years as chairman of the Hispanic and Luso-Brazilian Councils. He is a Comendador of the Portuguese Military Order of Christ. During the 1914-18 war he served first with the 7th Durham Light Infantry and later with the R.F.C. and R.A.F., as captain and flight commander.

During a recent luncheon given by the English Electric Co., Ltd., at the Connaught Rooms, London, Sir George H. Nelson, chairman and managing director, made a presentation on behalf of himself and his fellow directors, to **Mr. Harold S. Aspinall** on his retirement from the post of general export manager of the company, which took effect at the end of December last.

Mr. Aspinall joined the company in 1932 as manager of the Diesel Engine Department, and in 1934 was appointed deputy export manager, becoming general export manager in 1937. Mr. Aspinall has been assigned special duties with the company and continues to be a director of the English Electric Export & Trading Co., Ltd.

A second presentation was made by Sir George Nelson to **Mr. T. G. Tyson,** who has retired from the position of manager, London and the South. Mr. Tyson joined Willans & Robinson in 1912, and he represented them on steam and diesel work, becoming acting manager. When the English Electric Co. was formed in 1919, Mr. Tyson became manager of the Diesel Department in London. In 1930 he was appointed manager, London and the South, retiring in 1952.

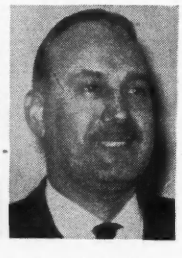
Sir George Nelson referred also to the retirement of **Mr. J. Aylmer,** who joined the company in 1907, and **Mr. H. T. Walker,** who had been with them since 1902. Mr. Aylmer went to Siemens Brothers Dynamo Works, Stafford, in 1907, as an apprentice. After serving his time, he proceeded to the Head Office, Caxton House, Westminster, in 1911, working in the Central Station and Power Department. When the English Electric Co. was formed he became a member of the new company and, in 1922, was made deputy manager, Manchester Branch. In 1926 he was appointed manager, Bradford Branch, and in 1929 he became manager, Colombo, Ceylon. Mr. Aylmer returned to Queens House, Head Office, in 1932.

Mr. Walker, who retired as from 31st December last, started his career with Siemens Brothers & Co. in 1903. When, in 1906, Siemens Brothers Dynamo Works, Ltd., was formed, he became a member of the staff of the new company, handling arc-lamps, meters and motors. In 1919 the Siemens Brothers Stafford works were acquired by the English Electric Co., and Mr. Walker was transferred. For many years he has been the senior estimating and contracts engineer in the Industrial Motor Section of London Branch.

Mr. C. W. Bloomfield, who in 1913 founded the Hackbridge Cable Co., Ltd., and later Bryce Electric Construction Co., Ltd., and the Mitcham Motor Co., Ltd., has retired from the boards of these companies. **Mr. W. McDonald** and **Mr. A. L. Foulger,** who have been with the companies since 1915 and 1926, have been appointed managing and deputy managing director respectively. Mr. Bloomfield retains his seat on the board of Hackbridge Cable Holdings, Ltd.

Mr. C. W. Bloomfield

Mr. W. McDonald



Mr. A. L. Foulger

OBITUARY

Mr. J. K. McCraith.—The death has taken place in hospital, at the age of fifty-eight, of Mr. J. K. McCraith, lamp and lighting sales manager at the Newcastle-on-Tyne office of the British Thomson-Houston Co., Ltd. He had been with the company since 1929 and had been lighting and lamp sales manager for ten years.

Lady Rutherford.—The death has occurred in Christchurch, New Zealand, of Lady Rutherford, widow of Lord Rutherford, the celebrated physicist.

Mr. Edmund John Fox, late managing director of the Stanton Ironworks Co., Ltd., died on 18th January in his eightieth year at a nursing home at Tunbridge Wells.

Mr. Fox was one of the pioneers of electrical power generation who worked with Col. R. E. B. Crompton, whom he joined as pupil in 1894, leaving in 1902. He joined Willans & Robinson, Rugby, at a time when the reciprocating engine was about to be replaced by the steam turbine, and he had much to do with this development and of power station condensing plant. He later joined Stewarts & Lloyds, and then from 1917 to 1942 was on the board of the Stanton Ironworks, for some years as managing director. In this position he was concerned with the development of spun cast iron pipes, pipes with cement linings and concrete lighting and power standards. For some years he was a director of Crompton Parkinson, Ltd. He was also on the board of the Davy & United Engineering Co. as chairman from 1931 to 1953. In the old days he and Mrs. Fox, who survives him, were prominent in the festivities of the I.E.E. at the former Hotel Cecil.

WILLS

Mr. L. St. L. Pendred, C.B.E., editor-in-chief of *The Engineer* 1905-46, a past-president of the Institution of Mechanical Engineers, who died on 20th November last, left £10,737 gross (£10,204 net).

Mr. W. C. Crane, a section head in the Commercial Department of the London Electricity Board, Western Sub-Area, who died on 23rd October last, left £7,203 gross (£5,982 net).

Mr. E. B. Bull, O.B.E., founder and managing director of Welwyn Electrical Laboratories, Ltd., who died on 10th August last, left £162,813 gross (£155,795 net).

Mr. F. W. Adams, retired electrical fittings manufacturer, Prestwich, who died on 7th November last, left £11,244 gross (£11,194 net).

British Trade Talks in Moscow

ON Tuesday thirty-three business men representing twenty-six British firms left London for trade discussions in Moscow. Led by Mr. J. B. Scott, sales director of Crompton Parkinson, Ltd., the party comprises high level executives, all capable of signing contracts in Moscow. They include Lord Forrester (Enfield Cables, Ltd.), Mr. S. A. Lane (Brush group of companies), Mr. W. Glass and Mr. J. B. McRostie (Johnson & Phillips, Ltd.), Mr. F. F. H. Schroeder (Lancashire Dynamo & Crypto, Ltd.), Mr. A. N. Jackson (J. Stone & Co. Holdings, Ltd.), Mr. A. F. Jeans (Mullard Overseas, Ltd.), and Mr. T. L. Kendall (Ruston & Hornsby, Ltd.).

After explaining the objects of the tour before leaving, Mr. Scott said that the original aim was to be in Moscow before Christmas, but as the necessary details could not be arranged in time the visit was postponed until the New Year.

Some of the Moscow party: Mr. J. B. McRostie, Mr. J. B. Scott, Mr. A. N. Jackson and Mr. A. F. Jeans

This was, they understood, the largest group of buiness men to visit Moscow since the war. They all had high hopes of the venture and each of the companies represented was capable of handling a large volume of business. Some of the group, including his own company, had already had considerable orders from Moscow, but they believed and hoped that this would be the beginning of a constant two-way traffic in East-West trade, which could only be to their mutual advantage. Some of the party would be returning via Poland.

E.D.A. Public Speaking Competition

THE first two contests in this year's E.D.A. Public Speaking Competition were held at the Lighting Service Bureau, 2, Savoy Hill, London, on 19th January. There were eight competitors in the all-London Area men's competition, which was won by Mr. B. D. Lawlor, commercial assistant at the London Electricity Board's headquarters. Mr. Lawlor, who spoke on "Bringing Electricity to Rural Areas," now goes forward into the national final, which will be held in London on 23rd April. Second place was awarded to Mr. R. Hawkins, senior service centre assistant, Downham, who spoke on "The Housewife in the Reigns of the Two Elizabeths." Mr. Hawkins was not eligible to take the prize, however, as he won the London Area contest last year, and so the second prize was awarded to Mr. H. V. Pountney, who was adjudged to have come third. Mr. Pountney is an accountancy assistant at the Central Costs Office, Northern Sub-Area, and the subject of his address was "The Place of Electricity in the National Economy." Mr. F. C. Fenton, chief commercial officer, and Mr. J. Middleton, education and training officer, both of the L.E.B., and Mr. J. A. Stedman (E.D.A.) were the judges for the men's competition, and Mr. A. W. Bonell, showroom and trading superintendent, L.E.B., was in the chair.

Left: Mr. B. D. Lawlor receiving his cheque from Mr. F. C. Fenton. Right: Miss Ruth E. Ward receiving her cheque from Mr. A. W. Bonell

The London, South Eastern and Southern Areas combined in the women's contest, in which there were six competitors. First and second places went to the South Eastern Electricity Board's entrants, the winner being Miss Ruth Ward, a demonstrator in the Sutton Service Centre, who spoke on "Life Without Electricity." She now goes into the national final. Miss Margaret Higgins, a showroom assistant at the Surbiton Service Centre, who also spoke on "Life Without Electricity," was placed second. Mr. W. B. Leigh of the South Eastern Electricity Board was in the chair for the women's contest, and Mr. Bonell, Mr. Stedman and Mr. R. E. Gamlen (South Eastern Board) acted as judges.

PARLIAMENTARY REPORT

IN the House of Commons, which last week resumed its sittings after the Christmas recess, Mr. James Stuart introduced the Electricity Reorganization (Scotland) Bill, to transfer the functions of the Minister of Fuel and Power in Scotland in relation to electricity to the Secretary of State; to establish the South of Scotland Electricity Board; to transfer the functions of the British Electricity Authority in the south of Scotland and of the Scottish Area Boards to that Board; to amend the Hydro-Electric Development (Scotland) Act, 1943; and for purposes connected therewith. The Bill, a summary of which appears on page 184, was read a first time.

Inland Frequencies

Captain Orr asked why frequencies for inland mobile radio were allocated by the Overseas Telecommunication Department of the Post Office.

Mr. Gammans said the reply was because that Department dealt with the assignment of all individual frequencies. This was a specialized task which covered not only inland mobile radio services, but many other services, both mobile and point to point, many of which affected overseas administrations.

New Television Stations

Brigadier Medlicott asked the Assistant Postmaster General if work had actually started on the construction and assembly of the equipment for the East Anglian television station and what was expected to be the area that it would effectively cover.

Mr. Gammans said that authority had now been given to the B.B.C. to set up a station to serve East Anglia, and also five other stations not covered by the present programme, i.e., at Dover, Inverness, Londonderry, Towyn and Carlisle. The Corporation intended to acquire a site for the East Anglia station some ten miles south west of Norwich, and hoped to provide a temporary transmitter within twelve months to serve Norwich and its immediate surroundings. The permanent transmitter which would be set up later was expected to serve most of East Anglia not covered by the London station.

In reply to questions by Lady Tweedsmuir, Mr. John Rodgers and Captain Orr, Mr. Gammans said that the location, power and coverage of the new television stations were matters for discussion between the Postmaster General and the new corporation when it was set up. It seemed probable that the permanent stations would have a range of 30 or 40 miles, but it might be decided to start with temporary stations of lower power. The two channels in Band III to be allocated initially to television were 186–191 Mc/s and 191–196 Mc/s, and he would refer to these as Channels 8 and 9. Channel 9 would be assigned to London; and if stations were established in the Midlands and South Lancashire, Channel 8 would be assigned to the Midlands and Channel 9 to South Lancashire.

Flashing Beacons

Sir Thomas Moore asked the Minister of Transport if he was now satisfied with the experimental use of the flashing traffic beacons; and whether he would consider altering their design and colour.

Mr. Lennox-Boyd said he was satisfied that the flashing beacons were effective and he did not contemplate at present any alteration in their design or colour.

Telephone Cables

Mr. Eric Johnson asked how far the delay in the provision of telephones was due to difficulty in obtaining adequate supplies of telephone cables.

Mr. Gammans said there was no difficulty in obtaining supplies of telephone cable from the manufacturers. Delay in expanding the local cable system arose from restrictions on capital investment; but as the position got easier, they were gradually increasing the allotment for local cables.

Severn Barrage Scheme

Replying to questions on the Severn Barrage Scheme by Mr. Peter Freeman and Mr. Awbery, Mr. Joynson-Hicks, Parliamentary Secretary, Ministry of Fuel and Power, said that judgment on the economic and technical soundness of this scheme must await the outcome of research now being conducted by the Department of Scientific and Industrial Research. Results of preliminary experiments with a small model were expected by the end of the year and a building to house a larger model should be ready about the same time. But he had been warned that there were many technical difficulties to be overcome and that early results could not be expected from the further experiments that would be necessary.

Power Cuts

Brigadier Terence Clarke asked the Minister of Fuel and Power how many power cuts there were during the years 1953, 1952, 1951, 1950.

Mr. Joynson-Hicks said that power cuts due to shortage of generating plant were as follows: none in 1953, twelve in 1952, one hundred in 1951 and eighty-five in 1950.

MINES AND QUARRIES

THE Mines and Quarries Bill now before the House of Commons consolidates and revises the law relating to safety and health in mines and quarries at present comprised mainly in three existing Acts. Section 68 of the Bill deals with electricity and electrical apparatus. It stipulates that regulations may make provision with respect to (*a*) the generation, storage, transformation, transmission and use of electricity at mines; and (*b*) the use, construction, installation, examination, repair, maintenance, alteration, adjustment and testing of electrical apparatus and electric cables at mines; and in particular for requiring the cutting off of the supply of electricity to apparatus in a part of a mine below ground at any time at which the amount of inflammable gas in the general body of the air in that part exceeds the prescribed percentage by volume and in such other circumstances as may be prescribed.

If an inspector is of the opinion that the use of electricity in a mine or part of a mine might involve substantial risk of an explosion of gas or dust he may serve a notice on the manager of the mine prohibiting or restricting the use of electricity accordingly.

The Bill deals among other things with ventilation, lighting and the operation of winding and hauling apparatus. Copies are available from H.M. Stationery Office (price 3s).

E.C.A. Branch Dinner

THE annual dinner of the Bristol branch of the Electrical Contractors' Association was held at the Royal Hotel, Bristol, on 22nd January.

Mr. S. F. Steward, chairman of the South Western Board, proposing the toast of the "Association," claimed that increase in the use of electricity in the South-West had been greater than in any other area of the country. He said there was every sign of a new impetus to electrical development, which indicated success and prosperity for members of the E.C.A., who, although they were competitors, were also partners. Competition was a spur to improved service and efficiency.

Electricity in the Home

Better Conditions for Electrical Development Work

THE improved prospects for domestic electrical development are reflected in the excellent attendance at the annual conference of electrical housecraft advisers and senior demonstrators which is being held in London this week by the British Electrical Development Association and the Electrical Association for Women. Presiding at the opening session, Dame Caroline Haslett, chairman of the E.D.A. Council and director of the E.A.W., emphasized that the B.E.A. and manufacturers believed in electrical development and were pooling resources to see that women got the best out of electricity. The day of negative approach had gone and there was no excuse for not devoting all their energies to encouraging the use of labour saving devices.

In his opening address Sir Henry Self, deputy chairman, B.E.A., and president of the E.D.A., said the electrical industry had had its promotional freedom restored and friends outside were beginning to show a little tolerance. The installation of the new plant meant that old plant need be used only as stand-by. By being able to employ the new plant to carry the whole of the night load it was possible to secure much more economical operating conditions.

Generating capacity now tended to exceed demand and it was necessary to let consumers know that they were performing a public service by installing a wide range of appliances so as to increase diversity of use. The ultimate approval of the public would turn on whether electricity charges could be held down. This depended largely on the battle between capital charges and the savings engineers achieved by improved efficiency. In 1948 capital charges totalled £48 million, to-day they were £73 million a year and in ten years they would be £175 million. On the other hand the overall thermal efficiency during the past five years had improved from 20·87 to 22·72 per cent; resulting in a saving of 7·5 million tons of coal a year. Plant with an efficiency of 30 per cent was now being installed and great savings could be expected when the whole system was operating at this efficiency or higher.

Speaking on the subject "Electricity in the Home—a National Asset," Col. B. H. Leeson, director of the B.E.A.M.A., declared that every housewife who installed electrical appliances was helping to strengthen the export industry. Britain's export trade depended on the supply of goods of a quality which could not be surpassed. The fundamental requirement for expansion of exports was a stable and prosperous home market. It was imperative that appliances for the home market should be freed from artificial handicaps, such as purchase tax, and it was a short-sighted policy to supply the home market with low-quality goods to meet the price situation. This could only lead to manufacturers having to produce uneconomically two qualities of apparatus.

Domestic Electrification in Germany

On Tuesday afternoon, Miss Marguerite Patten (B.B.C. Television) spoke on the subject of "Effective Cooker Demonstrations." In the evening Miss E. J. Sharp, senior demonstrator of the Oldham Sub-Area of the North Western Electricity Board, presented her Caroline Haslett Trust lecture under the title "Western Germany To-day—Electricity for the Home." She said that development had been rapid, one company reporting an increase of 300 per cent in the number of its consumers between 1950 and 1953. The tremendous influx of refugees from Eastern Germany brought problems to the supply companies. Off-peak tariffs were available for water-heating, the preparation of animal feeding stuffs and, in some cases, to factories. The domestic tariffs were based on a fixed charge per room plus a kWh charge. Employees of the companies were given concessionary terms, paying only the kWh charge.

Not all the companies sold appliances. One she visited had an arrangement with local private contractors whereby appliances could be nominally bought by the public from the contractors—the company meeting the contractor's bill and charging instalments to the consumer on the monthly electricity accounts. Neither this nor another company to which she was attached carried out any installation work. Rural development was being slowed up by labour shortage. Working hours differed very considerably from those in this country. Workmen began at 7 a.m. Service centres were open on week-days from 7.15 a.m. to 6.0 p.m. and on Saturdays from 7.15 a.m. to 5.0 p.m., the assistants having a half-day off a week.

At the "Roeder" factory it was noteworthy that glass wool was not used for lagging but three layers of crumpled tinfoil were considered more effective. Combination cooking ranges were manufactured permitting the housewife to use solid fuel and/or gas or electricity.

Wall fittings and table lamps were used to a much greater extent than in this country. Cookers were normally finished in black and white. Grills and splash plates were not provided. Solid plates appeared to be used almost exclusively. The ovens were deeper and narrower. Thermostats were being more widely used but frequently separate switches were used for "under" and "over" heat. Launderettes were to be found in most towns.

A domestic clothes dryer taking the place of a wringer had proved very popular. Convectors appeared to be more used than here. Instead of purchase tax there was a "turn-over" tax but its incidence did not seem to be so heavy. Refrigerators were very expensive. Some kettles were in use but a more popular appliance was the "Rapid-kocher" which not only served as a kettle but could be adapted for heating milk and boiling eggs. Under-the-basin storage water heaters were more popular than here.

In the supply area of the Weser-Ems company where more than 95 per cent of the rural premises were connected, the "Example Farm" scheme has been revived. From each of the eighteen local authorities in the supply area, they obtained the names of six farmers known to have a progressive outlook and to maintain a high standard of farming. Two farms were finally chosen from each six and the farmers concerned were then invited to say what electrical appliances they would like to see installed on their farms. The company then offered to install the selected appliances on six to twelve months' trial, provided that the farmer would pay for the cost of wiring—on easy terms if desired. The farmer was expected to allow interested people to visit the farm. At the end of the trial period he was allowed to purchase the appliances at cost price.

At the Darmstadt showrooms facilities were available for housewives or school children to come along and cook for themselves under ideal conditions.

INDUSTRIAL NEWS

Engineering Wages Inquiry

AT ITS concluding session on 21st January the Court of Inquiry dealing with the claim for a 15 per cent increase in wages made by the Confederation of Shipbuilding and Engineering Unions heard arguments about the possible effects of the increase upon prices.

Speaking for the unions, Mr. J. Tanner denied that the result would be the pricing of British goods out of export markets. He refused to accept the gloomy picture of export prospects painted by the employers. Short of a world recession there was no need to worry unduly about the future of engineering exports. He contended that the granting of the increase would cost only about £75 million a year, adding less than 3·17 per cent to the total costs of the industry.

Sir Percy Mills, representing the Engineering Employers' Federation, said that there had been a very significant drop in export orders in 1951–53. They were most apprehensive as to the ability of the industry to maintain exports if wages and prices were increased, whereas the national need was for a substantial and progressive increase in exports. Home orders also showed a downward tendency.

While the 15 per cent wage increase if applied to the 1,634,000 workers covered by the Employers' Federation would cost £76 million, the extension of the increase to all the 3,727,000 workers in the engineering and allied industries would cost about £171 million.

The Court adjourned and will issue its report and recommendations in due course.

Electrical Contracting Dispute

The second week of the strikes called by the Electrical Trades Union in the electrical contracting industry closed with a statement by the Union that about 1,800 men were on strike on Saturday last. It is the Union's intention to continue the "campaign" and on Monday last about 7,000 electricians in the London area were called out, marking a change from "site" to area action. A meeting of electricians in the Merseyside area was called for Wednesday evening last. This was believed to be a prelude to the stoppage of about 1,600 men in that area.

During the last week Mr. L. C. Penwill, director of the National Federated Electrical Association, suggested to the E.T.U. that the dispute might be referred to an independent arbitrator of the standing of a High Court judge. To this the Union replied that it could not, at that stage, accept a plain reference to arbitration but it was "prepared to meet anybody at any time to find a formula which would lead to a settlement of the dispute through the industry's normal negotiating machinery."

Between 7,000 and 8,000 contracting electricians in London continued their strike on Tuesday, the second day of a week's stoppage. Mr. Penwill said that about 70 per cent of the London operatives were on strike.

The men are mostly engaged in new construction and installation and among work affected are the extensions to five power stations and new electrical work in the docks and in the Houses of Parliament. Mr. W. C. Stevens, general secretary of the E.T.U., said that special sanction had been given to members to continue working where they were employed on humanitarian or safety work, or public entertainment.

In addition to the London stoppage, 1,800 E.T.U. men on sites in various parts of the country are continuing their indefinite strike which they started last week.

E.P.E.A. "Action Committee"

The "Action Committee" of the Electrical Power Engineers' Association is to report to-morrow (Saturday) to the General Purposes Committee of the Association upon the next step to be taken to advance the Association's campaign for a substantial improvement in the status and salaries of electricity supply engineers and technologists. Lord Citrine (chairman, British Electricity Authority) has told Mr. Harry Norton (general secretary, E.P.E.A.) that he will refer the Association's request for a direct meeting to the next meeting of the B.E.A. to be held on 11th February.

"Three Arts 1954" Exhibition

Contemporary lighting fittings are to be seen in their appropriate settings in the "Three Arts 1954" Exhibition which until this evening (29th January) is being held at Arthur Sanderson & Sons' showrooms at 52–53, Berners Street, London, W.1. Several striking effects have been achieved with a wide variety of different materials and devices. Manufacturers who have supplied fittings include Merchant Adventurers, Ltd.; Cone Fittings, Ltd.; Hiscock Appleby & Co.; Bernard Shotlander; and George Forrest & Son, Ltd.

Public Transport Conference

The Public Transport Association announces that the two papers to be read at the Blackpool Conference are "Brakes as applied to Public Service Vehicles," by Mr. S. C. Vince (chief engineer, Birmingham and Midland Motor Omnibus Co., Ltd.), on 19th May, and "Bus Garages and Bus Stations," by Mr. A. A. Jackson (general manager and engineer, Bolton Transport Department), on 20th May.

Electrical Commercial Travellers

The annual luncheon of the Electrical Trades' Commercial Travellers' Association will be held on 19th February at the Connaught Rooms, Great Queen Street, London, W.C.2. The principal guest will be Mr. J. Eccles, deputy chairman (operations), British Electricity Authority. Tickets (17s each) can be obtained from Mr. L. A. Fickling, c/o Linolite, Ltd., 118, Baker Street, London, W.1.

Prices of Materials

In the accompanying table we give the basis prices of the more important materials used in the electrical industry. The figures given are the selling prices and are those quoted on Tuesday last.

ALUMINIUM Ingots	ton £156 0s 0d
COPPER, H.C. Electro	ton £219 0s 0d
Fire Refined 99·70%	ton £218 0s 0d
Fire Refined 99·50%	ton £217 0s 0d
COPPER Tubes ..	lb 2s 2½d
Sheet	ton £281 10s 0d
H.C. wire and strip	ton £252 0s 0d
LEAD, English ..	ton £83 10s 0d
Foreign	ton £82 0s 0d
MERCURY	flask £63 0s 0d
TIN, block (English) ..	ton £647 10s 0d
ZINC, G.O.B. Foreign	ton £70 0s 0d
Electrolytic	ton £71 15s 0d
BRASS Tubes (solid drawn)	lb 1s 9½d
Sheet	ton £230 10s 0d
Wire	lb 2s 4½d
PHOSPHOR BRONZE Wire	lb 3s 7½d
PLATINUM	oz £27 0s 0d
RUBBER, No. 1 R.S.S. spot	lb 16⅛d–16⅜d

Prospects in Latin America

At a Press conference held in London last week, Mr. Heathcoat Amory, Minister of State at the Board of Trade, gave some of his impressions following his recent visit to Brazil, Argentina and Uruguay. He said that his visit was not made with the intention of entering into any specific arrangement, but was purely a good-will visit to study the trade situation on the spot and to discuss problems of trade with the Governments concerned and with industry. He had interviews with the Presidents of Brazil and Argentina and with the Vice-President of Uruguay.

He was not hopeful of any immediate increase in trade, but taking the long-term view he thought the prospects were better. The Governments of all three countries were keen on developing their own industries and trade with these countries would not necessarily be on the same pattern as in the past.

The outlook for British capital goods was better than for consumer goods. There would be intense competition for trade, particularly from Germany, and business was not going to be easy.

Mr. Amory emphasized the importance of continuous representation for exporters and the need for vigorous salesmanship. Conditions favoured the larger concerns who were able to maintain on-the-spot representation, and he suggested that small exporters should consider means of co-operating by such methods as the formation of export groups. The Governments were well disposed towards foreign capital, but in some cases conditions were attached to investments from abroad.

Iron and Steel Scrap

After consulting the Iron and Steel Board, the Minister of Supply has made the Iron and Steel Scrap (Amendment No. 2) Order, 1954, S.I. 1954 No. 50, affecting the acquisition and certain prices of iron and steel scrap. The Order limits the need for a licence to acquire iron and steel scrap to persons engaged in (*a*) the smelting of iron ore in a blast furnace with other metalliferous materials or the production of iron by any other process; (*b*) the production of steel by any process; (*c*) the casting of iron or steel by any process. It also removes tungsten steel scrap from price control and amends the instruction for calculating maximum prices where delivery is effected otherwise than by the British Transport Commission or licensed road hauliers. The Order came into operation on 21st January.

Mond Nickel Fellowships

The Mond Nickel Fellowships Committee invites applications for Fellowships of an approximate value of £900 to £1,200 for 1954. Fellowships will be awarded to selected candidates of British nationality with degree or equivalent qualifications to enable them to obtain wider experience and additional training in industrial establishments, at home or abroad, to make them more suitable for future employment in senior technical and administrative positions in British metallurgical industries. Each Fellowship will cover one full working year. Particulars and forms of application are available from the Secretary, Mond Nickel Fellowships Committee, 4, Grosvenor Gardens, London, S.W.1, and applications must be submitted by 1st June next.

Steel Tank Rectifiers in Ceylon

The first pumpless steel tank rectifiers to be installed in Ceylon are now in service on the Colombo municipal tramway system. These rectifiers, together with the associated a.c. and d.c. switchgear, were built by the General Electric Co., Ltd., and were supplied by the company's agents in Ceylon, Walker and Greig, Ltd., who were also responsible for the layout and installation of the complete substation. The rectifier equipment comprises two 350 kW units which convert the 11 kV, 3-phase, 50 c/s supply, provided by the Government Electricity Department, to the 550 V d.c. supply required for the tramway system. The rectifiers replace a 500 kW synchronous motor generator set formerly used for this purpose.

H.F. Cables DEF Specification

The Engineering Standards Co-ordinating Committee, Ministry of Defence, has recently issued DEF 14 for Radio Frequency Cables. This is a revision of G.D.E.S.23 which it replaced. An attempt has been made to standardize sizes and impedances and in so doing some new cables have been introduced and others listed as obsolescent. The specification is obtainable from H.M. Stationery Office, price 7s 6d.

New Lighting Showroom

Several novel features to permit the display of electrical equipment and lighting fittings to their best advantage have been incorporated in the design of the reconstructed showrooms of Troughton & Young (Lighting), Ltd., at the Lighting Centre, 143, Knightsbridge, London, S.W.1. The whole of the ground floor of the premises has been re-decorated and re-equipped to exhibit the many new designs of lighting fittings which have been added to the well-known "Ultralux," "Versalite" and "Mondolite" ranges.

The new "Ultralux" units on view include types incorporating open bases with threaded galleries. A radial fitting with three, four, six or eight arms and the "Diabolo" unit, which is a central spun metal fitting accommodating various reflectors and shades to give both upward and downward light, form the two basic features of the new "Mondolite" and "Versalite" units. An entirely new range of "Mondolite" floor and table standards includes models with triangular wooden bases and shades.

Marconi's Original System

At the request of the Science Museum, Marconi's Wireless Telegraph Co., Ltd., has provided a working demonstration spark transmitter and coherer receiver with morse inker, similar in principle to the original apparatus used by Marconi in his early experiments. Equipment operating on this principle provided a means of wireless communication for several years until further improvements were made. The apparatus, with the exception of the morse inker, was made by Mr. R. W. Piper, chief of test at the East Ham depot of the Marconi International Marine Communication Co., Ltd. The morse inker is an actual commercial instrument of the period, and was provided by the British School of Telegraphy.

Revised Testing Memorandum

The Ministry of Fuel and Power has issued a revised edition of Testing Memorandum No. 10—"Test and Certification of Intrinsically Safe Electrical Apparatus and Circuits." This new edition, which excludes much of the explanatory detail of the earlier one, i.e., information about the principle of intrinsic safety and the scope for its application, which at that time was not readily available, has been brought up-to-date. With the acquisition of further experimental data in the interval it has been possible to extend the scope of official certificates of intrinsic safety beyond that provided for in 1946, and apparatus can now be accepted for test in the following

The new showrooms of Troughton & Young (Lighting), Ltd., at Knightsbridge

inflammable gases and vapours: methane, pentane, hexane, heptane, acetone, benzene, cyclohexane, carbon monoxide, hydrogen, coal gas (town's gas), coke-oven gas and blue water gas. Additions will be made to this list from time to time as further information becomes available from the progress of research. The conditions of test for the approval of electrical shot-firing apparatus for use in coal mines, hitherto included in this memorandum, are now to be found in Testing Memorandum No. 5. Testing Memorandum No. 10 is published by H.M. Stationery Office, price sixpence net (7½d including postage).

Ultrasonic Testing

The F.E.18 Ultrasonics Panel of the British Welding Research Association is considering the need for a standard, single-hole, steel reference block for use in ultrasonic testing. Such blocks would need to be commercially available and should bear a mark showing that they are of approved design and quality. All firms and individuals interested in this possibility are asked to communicate with the Secretary, the F.E.18 Committee, British Welding Research Association, Abington Hall, Abington, Cambridge, from whom further information may be obtained.

Co-operative Information Service

We have received from the secretary, Mr. Roy D. Rates, Central Public Library, High Street, Acton, W.3, particulars of the Co-operative Industrial & Commercial Reference & Information Service which was organized a short time ago by the public libraries in the West London area with the help of a number of large industrial concerns and research associations. The Service is designed to provide free technical, industrial and commercial information from the resources of the libraries and the other organizations participating in the scheme. Those who are interested in the scheme are invited to telephone the secretary (Acorn 3295) or any public library in the West London area.

G.E.C. Witton Works

The largest of the manufacturing centres of the General Electric Co., Ltd., is its Witton Works, Birmingham, where the principal group of factories is devoted to the manufacture of heavy electrical plant and switchgear. The various workshops, laboratories and offices cover an area of over 60 acres, and the total area of the Witton site, which includes the Magnet Club building, playing fields and land reserved for works extensions, is over 144 acres. The company has issued a well produced brochure, profusely illustrated, in which it briefly outlines the main features of the Witton Works. The illustrations include sections of the engineering, small motor, rectifier, h.v. switchgear and transformer, and moulded insulation works, and installations of generating plant and other equipment in this country and overseas made by the company.

Fan Engineering Handbook

In 1944 the Fan Manufacturers' Association was formed to provide a central organization to co-ordinate and standardize terms used in the industry, to interchange technical information and discuss all questions affecting the industry in its technical relations with the many classes of fan users and the public. The Association has now produced the "Handbook of the Fan Engineering Industry" to convey a general impression of the industry. After dealing with the objects of the Association and its organization, the handbook deals with the construction of fan plant and describes the various applications. It is profusely illustrated with pictures of industrial installations. The handbook is obtainable from the Association at 59–62, High Holborn, W.C.1, at 3s 6d post free.

Building Exhibitions

Two building exhibitions organized by local educational authorities in co-operation with the Ministry of Works will be held at technical colleges in London and Norwich during February. The Minister of Works will open the first, at Willesden Technical College, Denzil Road, N.W.10, on 1st February, and the exhibition will remain open until 6th February. The exhibition at Norwich will be opened by the Lord Mayor of Norwich on 16th February. It will be held in the Norwich City College, Ipswich Road, and in the School of Art, St. George Street, and will run until 20th February.

"Building To-day" is the theme of Willesden's exhibition, and in addition to displays by building development associations and the Ministry of Works, equipment used in connection with coal, gas and electricity will be on view.

Coal Production in 1953

In a statement upon the work of the National Coal Board last year the chairman, Sir Hubert Houldsworth, Q.C., shows that the total production in Great Britain was 223·52 million tons, a decrease of 0·6 per cent on the preceding year's figure. Dealing with consumption, the chairman says that increased sales of electricity resulted in a rise of a million tons in power station consumption, in spite of improved generating efficiency, but gas sales and gasworks consumption were lower.

Electric Blanket Fatality

An inquest was held at Coventry recently on Mrs. Irene Ann Cleydon (58), who died from heart failure caused by a shock from an electric blanket. Burns on her body, caused by the electric blanket in her bed catching fire, occurred after death. Mr. L. J. Carter, an electrical engineer, said that the burning was probably due to a small short circuit on the element caused by normal wear and tear, and a section of the element, embracing part of the blanket, became considerably overheated. It was dangerous to sleep with an electric blanket switched on. A verdict of "accidental death" was recorded.

Suction Cleaner Handbook

Mr. H. M. Smith, cleaner sales promotion manager for Electrolux, Ltd., has written a small sales manual covering the selling of Electrolux suction cleaners, which is being circulated to members of the trade who handle the company's products. Although the booklet naturally relates to the company's suction cleaners there are many hints which can be applied to the selling of any appliance.

Trade Announcements

The **Brush Electrical Engineering Co., Ltd.,** has opened a new branch office to serve East Anglia at 4/5, Lloyds Chambers, Lloyds Avenue, Ipswich (telephone: Ipswich 2749). The manager appointed for this area is Mr. G. M. Ingram.

Elliott Brothers (London), Ltd., have transferred their Manchester branch office to 66, Deansgate, Manchester, 3 (telephone: Blackfriars 7752). The **Fisher Governor Co., Ltd.,** an associate of Elliott Brothers, will also operate in the Manchester area from this address.

Catalogues and Lists

A. F. Bulgin & Co., Ltd., By-Pass Road, Barking, Essex.—144-page illustrated catalogue of electronic and electrical components, together with index (192).

Croydon Precision Instrument Co., 116, Windmill Road, Croydon, Surrey.—Leaflet illustrating a comprehensive range of the company's instruments (53).

International Combustion, Ltd., 19, Woburn Place, London, W.C.1.—Illustrated catalogue describing the "Raymond" automatic pulverizer and lime conditioner, and a leaflet on the "Raymond" screen pulverizer.

Automatic Telephone & Electric Co., Ltd., Strowger Works, Liverpool, 7.—Illustrated road safety leaflet on "Electro-Matic" vehicle actuated signals.

W. T. Henley's Telegraph Works, Co., Ltd., 51–53, Hatton Garden, London, E.C.1.—Folder illustrating the new "Henley" double-pole connector box (43).

Simmonds Aerocessories, Ltd., Treforest, Pontypridd, Glamorgan.—Illustrated priced leaflets describing the new "Surform" hand servicing tool and plane (developed in association with Firth Brown Tools, Ltd.).

Sturtevant Engineering Co., Ltd., Southern House, Cannon Street, London, E.C.4.—Illustrated technical brochure on turbo exhausters and blowers (5602).

Belmos Co., Ltd., Bellshill, Lanarkshire.—Leaflet on the type VO.3C wall-mounting automatic direct-on contactor starter (K.300).

Ward & Goldstone, Ltd., Pendleton, Manchester, 6.—40-page catalogue on electric wires and cables, with index (W).

Engineering in Europe

Abstracts from Foreign Technical Journals

The electromagnetic energy transferred to an overhead conductor from a lightning stroke is dissipated partly in the conductor resistance, partly by leakage and dielectric losses of the insulators, and by corona effects. Conversion into heat plays a very subordinate role, and only if the impulse waves are very steep-fronted (high frequency). In surge divertors only a negligible part of the energy is converted into heat. That is why the finite earth resistance still has to make a great contribution to the final "annihilation" of the surge waves, particularly in a line without earth wires; it also renders the waves more harmless by reducing their steepness and amplitude.

The author shows this theoretically by a simplification of Carson's theory, yielding a convenient formula for the calculation of the distortion by the earth resistance of a rectangular surge wave which holds good for single- and multi-pole waves. It is seen that the attenuation of the waves is greater for smaller height above ground of the conductors, and also for multi-pole (as against single-pole) waves. The influence of the earth resistance also increases with increasing conductor diameter for single-pole waves, increasing earth resistance and shorter wave tail. The author's theory is corroborated by experimental results obtained in Sweden.—"Contribution of the Earth Resistance to the Neutralization of Surge Waves," V. Chura, *Elektrotech. Obzor*, Vol. 42, No. 6, pp. 317–324, 1953, in Czech.

Power Supply Transformers

The fact that between generator and consumer the power is transformed rarely less than three, and frequently as often as five, times implies that the total installed power of the transformers of a system may exceed the maximum system load by factors of the order of six and more (considering necessary stand-by installations). Economic operation of power systems is therefore conditional upon the maximum reduction of copper and iron losses and total weight of the transformers as well as on their optimum durability and reliability in service. However, the conditions are complicated by the fact that the loss reduction must be bought by higher primary costs; thus correct solutions must be based on a balance between capital and energy production costs.

The author suggests utilizing the lost heat by the intermediary of a heat pump for hot water supply, improving the transformer cooling and thus, indirectly, the transformer's service life. The introduction of cold-rolled transformer sheets reduces, on the one hand, the iron losses in the transformer and, on the other hand, enables higher flux densities to be used, thus also reducing the weight of the transformer materials (iron as well as copper). In addition, the cold-rolled sheets improve the regulation of the transformers ("self-regulation"). This applies particularly to e.h.v. transformers.

Transformer breakdown statistics reveal that 30 per cent of all breakdowns are due to overvoltages, 30 per cent to ageing of insulation and oil and dynamic stresses of short-circuits, 30 per cent to incorrect switching or operation of auxiliaries, 10 per cent being unexplainable. However, surge prevention and protection, and protection of the transformer insulation are steadily improving, so that transformers may now serve 30–40 years if properly supervised and maintained.—"Transformers in Power Supply," W. Schafter, *Elektrizitätswirtschaft*, Vol. 52, pp. 436–439, 1953, in German.

Current Transformer Design

The saturation of the steel cores of current transformers used in system protection has an adverse effect on the performance of the protective systems, since the full short-circuit current is carried by the phase affected by an external short-circuit, whereas the sound phases carry only fractions of the s.c. current. Thus the steel cores of the current transformers of the affected phase become saturated, but not those of the transformers of the sound phases, with the result that the unbalance currents increase and may prevent the operation of the protection. Another drawback of steel-cored current transformers is the large time-constants of their secondary windings resulting in a slow damping of the free currents of transient processes.

An experimental investigation on the use of air-cored current transformers showed that toroid-coil transformers can easily be made as sensitive as required and have obviously the great advantages of proportionality between secondary e.m.f. and primary current, small time-constants, independence of external fields and steel masses, etc. Their thermal and dynamical characteristics are also satisfactory. Their design is very simple as shown by two numerical examples, and experimental results in differential protection circuits confirmed the correctness of the theoretical considerations.—"Sensitivity of Relay Protection with Current Transformers having Cores of Non-Magnetic Materials," Yu. N. Katargin, *Elektrichestvo*, No. 6, pp. 32–35, 1953, in Russian.

Soil Investigations

The basic circuit of an instrument for soil investigations comprises a cranked magneto sending current through the primary of a transformer to one earth electrode, returning through another earth electrode to the magneto. The secondary winding of the transformer forms part of another circuit containing a pair of earth electrodes, one of which is connected through an indicating instrument to a tapping on a potentiometer or compensating resistance.

The electrodes of the secondary circuit are inserted in the ground between the "primary" electrodes and are known as "potential probes." A voltage drop is set up between them which depends on their spacing and the resistance of the soil. This voltage drop is compared with that produced by the secondary current in the compensating resistance. The setting of the latter (i.e., of the tapping mentioned above) at zero indication of the instrument shows the earth resistance. The resistance between the "primary" electrodes or "current probes" only determines the current in the circuit, hence the sensitivity of the arrangement.

This relatively simple instrument has had the most outstanding successes in geoelectric investigations since it permits of determining earth resistances down to ground water level (a depth corresponding to the electrode spacing) and, from the known resistance values of rocks and minerals, correct geological profiles, accurate to fractions of 1 m.

It has proved its value in preliminary prospecting for foundations of hydraulic engineering structures in connection with some of the biggest storage lakes and dams in the Alps, at a fraction of the costs of exploratory borings.—" Experience with the Siemens Instrument for Soil Investigations," H. Obpacher, *Siemens Z.*, Vol. 27, No. 5, pp. 281–284, 1953, in German.

Surges due to Arcing Earths

An experimental investigation, mostly on models, of the behaviour of overhead and cable systems under intermittent arcing earths indicated that, depending on conditions of de-ionization, the intermittent arc extinguishes near the zero passage of the current of the free oscillation or when the oscillations of the first kind change to those of the second kind, when the time-gradient of the current is almost zero and at the current-zero of the commercial frequency. The first and last of these cases are special ones. The experiments referred to also permitted the determination of the damping coefficients under various conditions.

If the arc is quenched near the current-zero of the oscillation, the overvoltage factor of the neutral cannot exceed 1·6, which is confirmed by all the oscillograms taken. Considering the experimental damping factors, the overvoltage factor in the sound phase is then 2·8 as a maximum. This, too, was experimentally confirmed.

At the instant of the transition from first-kind to second-kind oscillations or at the commercial frequency current-zero, the maximum voltage of the neutral cannot exceed phase voltage. The maximum voltage of the sound phase occurs at an ignition phase angle of 20 or 160 deg, the overvoltage factor then being 3·1 (independently of short-circuit current and arcing conditions), in agreement with experiments. It should be pointed out that in the actual system the phenomena must be less severe than in the model.

Since a well-maintained line insulation must withstand overvoltages of this order, the advantage of systems with isolated neutrals, viz. not requiring disconnection of a phase affected by a single-pole arcing earth, may be safely exploited. It is thus unnecessary to earth the neutral through a resistance as a surge-protection.—" Theory of Surges Set Up by Arcing Earths in a System with Isolated Neutral," Ch. M. Dzhuvarly, *Elektrichestvo*, No. 6, pp. 18–27, 1953, in Russian.

Thermal Conductivity of Insulants

The authors gained the conviction from the analysis of many breakdowns of electrical machines that a high percentage of these failures was due to bad thermal characteristics of the insulating materials used, i.e., to their insufficient thermal conductivity. To measure the thermal conductivity of these insulating materials therefore suggested itself as a starting point of investigations of the temperature distribution and heat dissipation processes in windings, although these could only be determined for stationary coils.

The differences between various classes of insulants are quite considerable and although some of the modern insulating materials are promising where possibilities of improvements are concerned, a careful selection and consideration of the combined characteristics in dielectric, mechanical and thermal respects is necessary for arriving at a satisfactory type of winding insulation.

What seems to be generally required is to obtain a foundation, or support, for the insulants and also protective varnishes of a kind more suitable for withstanding the expected maximum temperatures than the materials hitherto used. This could be achieved by using materials with a higher content of incombustible components or, in composite insulation, suitable combinations of incombustible and combustible materials. A promising material in this respect is glass fibre or sheet, particularly the special "insulation fibre" already on the market.—" Modern Conception of Windings and Thermal Conductivity of Insulating Materials," P. Mathivet and J. Duflos, *R.G.E.*, Vol. 62, No. 7, pp. 317–322, 1953, in French.

Friction in Integrating Instruments

The friction of the moving system and counting mechanism of integrating instruments causes an error in the readings of these instruments which depends on the magnitude of the integrated quantity and on the ratio of the static friction to the rated torque of the instrument. The latter ratio is constant and partly determines the electrical and mechanical characteristics of the integrating instrument, particularly its goodness factor. The relation between friction, rated torque and systematic errors of the counting system can conveniently be graphed and presented in the form of a nomogram from which the necessary corrections for the instrument readings are determined.

The author discusses these conditions, giving a succinct theory with reference to an induction-type electric meter and also shows how to use the results for the design of compensating devices (e.g., for the so-called " 10 per cent regulation "). The problem is obviously intimately connected with the type and quality of the jewel bearings, with the weight of the moving system, magnitude of the rated torque and with irregularities of production. All these factors are analysed and suggestions are made for minor improvements in the design of such instruments in " Influence of Friction on the Readings of Integrating Instruments," R. Drechsler, *Elektrotech. Obzor*, Vol. 42, No. 6, pp. 337–342, 1953, in Czech.

Amplidynes as H.F. Alternators

The amplidyne, basically a d.c. commutator machine and mostly used as a rotating amplifier in modern automatic regulation systems, may be shown to be equally suitable for the generation of a.c. of a frequency of a few cycles per second up to about 10 c/s. It then becomes valuable for investigations on self-controlled or servo-systems. It is true that the waveform of the alternating voltages generated by an amplidyne is badly distorted, particularly at the lowest frequencies, but this may be considerably improved by the introduction of a dry rectifier of the controllable-polarization type, for limiting the voltage, and thus the current, of the secondary field winding.

The author gives a theory of the amplidyne alternator with separate a.c. excitation, or with self-excitation by transformer coupling between consumer and field circuit. The set-up for taking no-load and short-circuit characteristics, and internal and external characteristics of the amplidyne alternator are discussed and several sets of characteristics are actually shown, as well as oscillograms of the basic waveform and that improved by a polarized rectifier. The effect of the latter is in some cases surprisingly good and results in an almost perfect sine-form.—" The Amplidyne as a H.F. Alternator," A. Vallini, *Energia Elett.*, Vol. 30, No. 6, pp. 358–366, 1953, in Italian.

Readers who require accurate full translations of any of the articles abstracted in this section can be put into touch with the translators who will supply them at current rates.—Editors, *Electrical Review*.

Electrical Manufacturing—1953

British Thomson-Houston Co., Ltd.

DURING 1953 a total of 225 MW of generating plant manufactured by the British Thomson-Houston Co., Ltd., was put into operation for the British Electricity Authority. Among overseas orders, in Canada a 25 MW, 60 c/s, double-extraction, hydrogen-cooled turbo-alternator set for the Ford Motor Co. was erected in 9½ weeks, which compared favourably with American practice. Other machines commissioned were a third 25 MW set at Colenso (South Africa) and a third 5 MW set at the Penal power station of the Trinidad and Tobago Electricity Commission. Smaller machines included a third 1 MW geared back-pressure set for Caroni, Ltd., Brechin Castle Sugar Factory, Trinidad, a second 3 MW set for Queenstown, South Africa, and a 1,600 kW geared back-pressure set at Pleystowe Mill, Queensland, Australia, for the Amalgamated Sugar Mills, Ltd.

The first of two B.T.H. 2,500 kW gas turbo-alternator sets for the Nairobi South power station of the East African Power and Lighting Co. has been tested at Rugby and dispatched to site. A 1,750 kW geared turbo-alternator set ordered for an industrial power house thereby represents a step forward in this field. The gearbox will have a speed reduction ratio of 10,000 to 1,500 r.p.m. and the gear tooth loadings will be increased substantially above normal rating.

The company has also been responsible for installing much hydro-electric plant, but that which has been most in the public eye is the Owen Falls power station of the Uganda Electricity Board. This station will be officially opened by the Queen in April and by that time the first two of six 16·7 MVA alternators will have been installed. At Bardufoss, Norway, an 18 MVA, 250 r.p.m. alternator has now been commissioned, as has a 14 MVA, 500 r.p.m. alternator at Oldereid.

In Spain the first of three 62·5 MVA, 214 r.p.m. alternators at Los Peares is on commercial load and the second will be commissioned early this year. Three 6,500 kVA, 250 r.p.m. alternators are in course of erection at Dona Aldonza and Pedro Marin power stations, on the Guadalquivir, and should shortly be commissioned.

Installation was completed of five motor convertors for I.C.I., each rated at 4,500 kW, 15,000 A, 240/300 V d.c., operating on an 11 kV, three-phase, 50 c/s supply. An order was received for a 6·6 kV, 6-pole, 7,500 h.p. slipring induction motor suitable for coupling to an existing 4,000 h.p. motor driving a wind tunnel fan, while a similar 850 h.p. 11 kV motor was ordered by the Bristol Aeroplane Co. for the same purpose. Other large machines dispatched included a 3 kV, three-phase, 1,200 h.p., 0·95 leading power factor synchronous induction motor, synchronous induction motors rated at 740 h.p., 1,125 h.p. and 1,480 h.p. for driving N.C.B. compressors, and a 700 h.p. synchronous geared-motor drive of 500/100 r.p.m. for the Firestone Tyre & Rubber Co., Ltd.

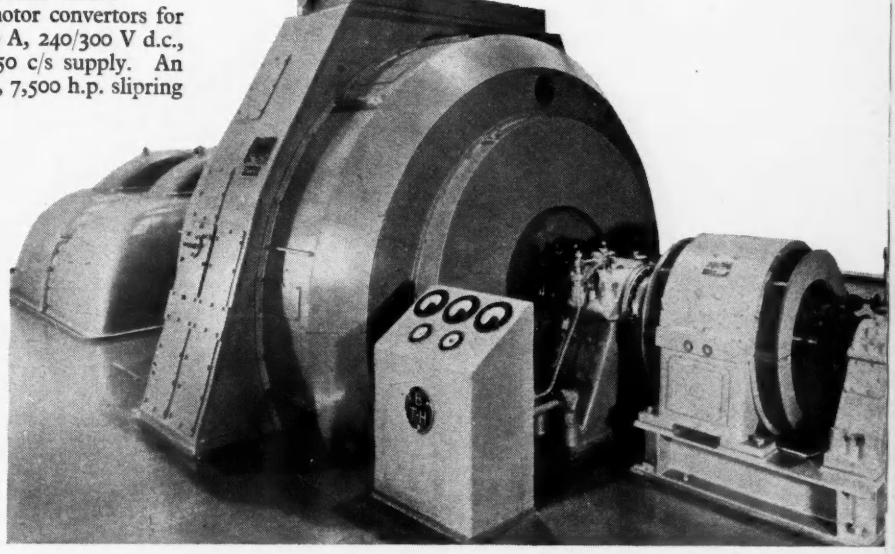
A landmark in the development of oil circuit breakers for 300 kV service and above has been the successful proving by the Switchgear Testing Co., Manchester, and the Fontenay Testing Station of Electricité de France, of the first production breakers for the State Electricity Commission of Victoria contract for thirteen 220 kV, 500 MVA shunt-arc oil circuit breakers. Employing the unit method of testing, a recovery voltage of 100 per cent was obtained on the 100 per cent symmetrical and asymmetrical shots.

Orders for outdoor bulk oil circuit breakers received during 1953 included one from the North of Scotland Hydro-Electric Board for a three-switch 132 kV, 1,500 MVA installation at Brechin. A large contract for the Electricity Commission of New South Wales covers the complete switchgear requirements for Wallerawang power station, including eleven 132 kV, 2,500 MVA shunt-arc oil circuit breakers, and eight 66 kV, 1,000 MVA type OW407 oil circuit breakers. For the Government of Orissa four 132 kV, 2,500 MVA shunt-arc breakers have been ordered.

The B.E.A. has ordered three 132 kV, 2,500 MVA air-blast circuit breakers for extensions at Brunswick Wharf generating station. During the year the commissioning of the first stage was completed and of seventeen breakers nine are already installed. Another order covers a 132 kV, 2,500 MVA extension equipment for Andover sub-station and all the existing breakers are to be uprated from 1,500 MVA to 2,500 MVA.

Development work is in hand on a new range of metalclad gear for 33 kV service. The main feature of this Class MF gear will be the introduction of vertical isolation at this voltage. The first Class QF double-bus switchgear with provision for earthing through the breaker has been dispatched and erection is proceeding at five London Electricity Board substations. Orders for Class Q switchgear continue to be received from the B.E.A. and industrial users. Export orders include a 12-panel, 6·6 kV, 150 MVA switchboard for Hong Kong, 6·6 kV Class QF

14 MVA, 500 r.p.m., 6·6 kV horizontal water-wheel alternator installed in Oldereid power station, Norway



equipments for six substations at the Shell Refinery, Bombay, and further repeat orders from the Ahmedabad Electric Supply Co.

Two more 75 MVA, 14/132 kV generator transformers for Staythorpe power station are approaching completion, making a total of six similar units for this station. During the year the first section of the 275 kV line (between Staythorpe and West Melton) was commissioned, the line being energized through the B.T.H. 120 MVA, 132/275 kV auto-transformer at Staythorpe. Other transformers completed during 1953 included one 72 MVA generator transformer and two 10 MVA house service transformers for Meaford " B," two 60 MVA, 132 kV transmission transformers for King's Lynn, six 15 MVA, 33 kV transformers for the London Electricity Board, three 10 MVA units for the East Midlands Board, two 10 MVA units for the North Western Board, and one 5 MVA transformer for the South Western Board.

Turning to transformers for export, units completed for South Africa have included four 40 MVA generator transformers for Orlando power station and two 15 MVA banks for the E.S.C. For Spain one 60 MVA bank and one 20 MVA and one 16 MVA transformers have been made, while for New Zealand four 16·67 MVA, single-phase, 220 kV units have been supplied. Transformers for India include three 20 MVA, 132/11 kV units for the Damodar Valley Project, and five 18·75 MVA, 66 kV, two 2·5 MVA, 11 kV, six 10 MVA, 66 kV and a number of smaller units for the Ahmedabad Electric Supply Co.

Development of the dry type hermetically sealed transformer for rectifier substations is one which may have a wider application where transformers are required in built-up areas and it is desired to avoid the use of oil. A 1,200 kW, 630 V rectifier unit has been supplied to the London Transport Executive system at Whitechapel which has been built to occupy the minimum of space; the rectifier cubicles stand right up against the transformer, with flexible interconnections. Similar units rated at 600 kW, 330 V are also under construction.

An order recently received from Imperial Chemical Industries, Ltd., for ten contact rectifiers each rated at 3,300/4,050 kW, 220/270 V, 15,000 A, is of outstanding interest because this type of rectifier has not previously been manufactured in England.

The year has been one of great activity in the marine department. Many ships for which the company has received important contracts for main propulsion equipment, auxiliary turbo-generating equipment, motors and control gear have now passed into service, and others are expected to be completed early in the year. In addition several important new orders have been received.

Traction business has been marked by an increased emphasis on diesel-electrics, and equipments have been supplied for works shunters, railway locomotives and rail-cars of six different types ranging from 155 h.p. to 1,000 h.p. The ten 1,000 h.p. locomotives for the New South Wales Government Railways were completed by the end of the year, while four of the eighteen 400 h.p. diesel-electric shunters for the Western Australian Government Railways were shipped.

Orders for 20 electric mine winders have been received during the year. To obtain exact performance in automatic winding, the company advocates closed-loop control for both Ward-Leonard and a.c. winders. Already, Ward-Leonard equipments operating on this principle are nearing completion for the N.C.B., and several a.c. closed-loop winders have been ordered. For Roslin, in Scotland, the 750 h.p. a.c. equipment is for automatic operation, the rotor operation gear being of the liquid type with amplidyne-electric servo control. Two a.c. winders have been ordered for Polkemmet Colliery and one of these is to be automatic; they have contactor-and-resistance rotor control gear.

In some cases closed-loop control may be used on a.c. winders which are not automatic, in order to provide extra safety features. Two 1,200/1,750 h.p. sinking winders of this type are in course of erection.

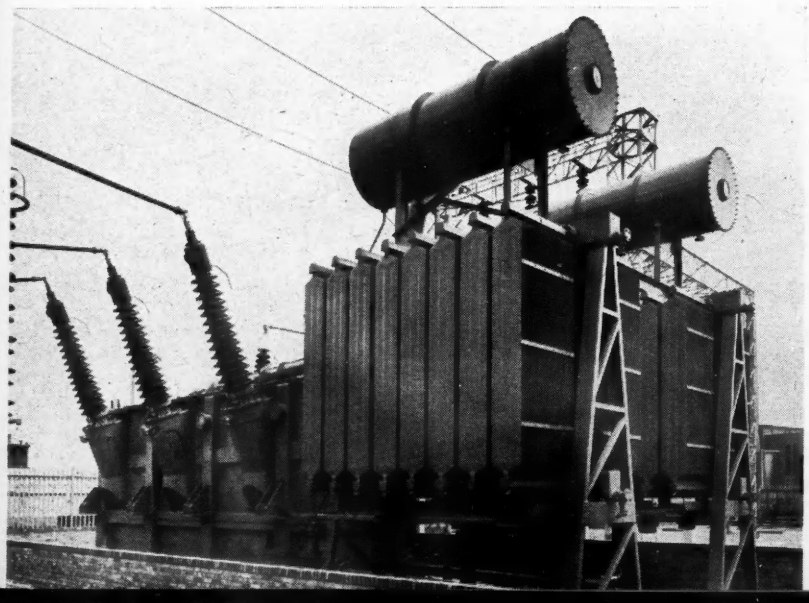
Apart from winders, a substantial amount of electrical apparatus for mines has been ordered, including turbine plant, transformers, motors of all types and sizes, control gear, lamps and lighting equipment.

The year has seen the completion of the large reversing mill modernization scheme at Round Oak Steel Works, Brierley Hill, Staffs. Here the B.T.H. has supplied one reversing cogging mill equipment with a 4,000 h.p. (peak 12,000 h.p.), 72/180 r.p.m. d.c. motor. The motors are supplied from two flywheel motor-generator sets. Further drives put into operation include two 1,250 h.p., 187·5/375 r.p.m. 500 V d.c. motors supplied from a 2,000 kW grid controlled mercury arc rectifier consisting of four pumpless steel tanks. These drives are for the fourth and edger stands of an existing continuous billet mill at the Stewarts & Lloyds works, Corby. In both the above installations the equipment included a large section of contactor control panel. The reversing mill equipment included also the latest form of amplidyne control.

In the electronics field the company has also been very busy and the apparatus concerned has ranged from welding controls, photo-electric equipments, batch counters and electronic motor controls, to voltage regulators, magnetic amplifiers, electronic servomechanisms, sound amplifying equipment, industrial communication systems and radar.

" Mazda " lamps and fittings have again featured prominently in many spheres of the nation's activities, including the Coronation ceremony. Over 12,000ft of trunking and nearly 1,000 fluorescent lamps and reflectors have been installed at the clothing factory of R. & W. H. Symington & Co., Ltd., at Market Harborough, and over 1,000 industrial mercury lighting fittings in the new Corby steel works of Stewarts & Lloyds, Ltd. A new and economical " Mazda " lighting technique has been developed for the floodlighting of football and sports meetings. New lanterns have been developed for street lighting and new lamps for the home.

The first 120 MVA transformer for the 275 kV transmission line between Staythorpe and West Melton



OVERSEAS ELECTRICAL TRADE

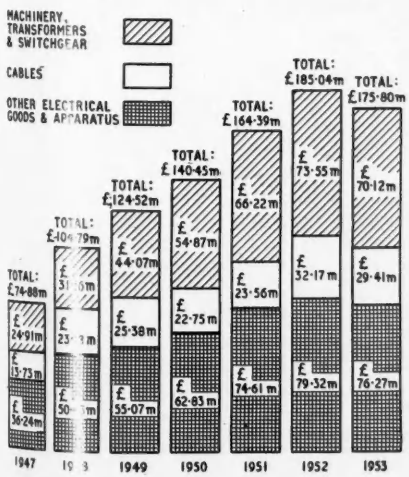
Decline in Exports in 1953

THE rapid expansion of British electrical exports which has been seen since the war was halted last year when the total value fell to £175·8 million from the 1952 total of £185·0 million, a reduction of £9·2 million, or 5 per cent. This occurred despite the relaxation of Australian import restrictions and an encouraging improvement in exports to dollar markets.

Against the background of the country's export trade as a whole which, at £2,582 million, just topped the 1952 figure, this may seem disappointing, but it should be remembered that electrical goods and machinery were affected to a smaller extent than many other products in the 1952 recession. Thus, while electrical exports were less in the second half of last year than in the corresponding period of 1952, they were still nearly 9 per cent above the 1951 level, whereas with some other engineering products, e.g., vehicles, the position was reversed.

Examination of the detailed figures in Table I will reveal some interesting changes in the pattern of our electrical export trade. Outstanding, perhaps, is the substantial increase in exports of commercial radio equipment (transmitters for public broadcasting and television, and radio communication, navigational aid and radar apparatus). Not only did the total value of

Comparison of electrical exports, 1947–53



Note that the figures for machinery, transformers and switchgear include vacuum cleaners and from 1949 onwards portable electric tools: from 1950 washing machines are also included

TABLE I.—ELECTRICAL EXPORTS

Class	December, 1952	December, 1953	Year 1952	Year 1953
	£	£	£	£
Telegraph and telephone cables and wires (submarine) ..	67,372	40,973	724,689	920,739
Ditto, not submarine ..	628,171	293,414	8,238,650	7,660,040
Cables and wires, paper insulated	1,088,315	862,885	10,596,826	11,013,032
Ditto, rubber insulated ..	512,813	414,197	7,465,493	5,002,837
Ditto, cotton, silk or artificial silk insulated	121,318	41,061	885,276	662,065
Ditto, enamel, glass or asbestos	130,594	67,059	934,849	975,779
Ditto, other	256,316	251,069	3,323,276	3,176,695
Commercial radio apparatus..	644,488	1,116,694	7,963,164	11,001,163
Domestic radio apparatus ..	288,961	294,408	4,435,957	3,517,680
Telegraph, telephone and signalling apparatus	1,488,225	1,469,159	17,119,061	17,522,891
Loudspeakers and microphones	44,019	49,602	723,891	460,540
Radio, telecommunication and electronic apparatus, components and parts, n.e.s. ..	429,046	488,298	5,844,647	5,246,953
Other radio,telecommunication and electronic apparatus ..	197,879	300,599	1,913,944	3,335,333
Cathode ray tubes	7,013	5,395	126,051	152,985
Other valves	245,577	179,285	3,489,296	2,047,264
Carbons	20,486	15,396	285,404	215,451
Lamps, exceeding 24 V ..	53,651	82,123	949,594	823,377
Ditto, not exceeding 24 V ..	20,086	25,754	409,173	263,443
Other lighting appliances ..	414,782	412,918	5,305,716	5,026,189
Primary batteries	199,274	182,965	2,251,320	2,264,455
Parts other than carbons ..	18,874	50,283	299,116	330,574
Accum. for motor vehicles ..	93,563	161,947	2,278,106	1,744,714
Ditto, traction	18,740	22,533	244,771	216,892
Ditto, radio	1,885	5,132	51,092	42,564
Other portable accumulators	114,951	78,176	1,141,325	510,335
All other accumulators ..	75,153	31,816	882,171	575,752
Parts and accessories ..	59,839	75,621	832,434	606,037
Cooking appliances	88,892	90,728	2,112,501	1,007,389
Heating appliances	80,856	71,846	998,369	823,244
Parts and accessories for cooker and heating appliances ..	59,790	77,745	975,596	875,711
Flat irons	48,973	63,101	748,277	652,813
Commercial elec. instruments	120,673	151,491	1,625,685	1,728,962
House service meters ..	84,057	94,687	1,615,438	1,014,318
Time recorders and time switches	11,912	20,010	138,053	195,451
Other electrical instruments..	135,678	142,223	1,419,574	1,667,785
Electro-medical apparatus (not X-ray)	35,185	38,094	496,557	475,607
X-ray apparatus, other than tubes and valves	67,575	89,337	786,880	742,093
Vacuum tubes	52,603	82,233	781,817	779,250
Permanent magnets	33,073	49,676	396,435	407,075
Insulating cloth and tape ..	41,979	46,820	934,479	545,532
Other insulating materials ..	62,995	65,514	1,055,322	735,758
Unclassified elec.goods and app.	505,521	550,139	6,900,468	6,856,272
Diesel driven generators, not exceeding 10 kW	363,405	109,863	4,898,704	1,096,300
Ditto, over 10 kW to 65 kW		93,579		1,647,230
Ditto, over 65 kW to 200 kW		141,130		1,128,239
Ditto, exceeding 200 kW ..	269,937	29,576	2,579,390	1,800,819
Other generating sets ..	413,431	211,222	2,487,876	2,698,576
Generators and parts of generators	899,129	714,508	6,959,207	8,451,217
Motors, railway, tramway and trolley-bus	7,160	—	43,428	234,819
Ditto, others not over ¼ h.p...	115,355	175,519	2,036,550	1,631,905
Ditto, over ¼ h.p. but under 1 h.p.	32,083	61,018	771,666	439,823
Ditto, from 1 h.p. to 250 h.p.	418,302	409,917	5,438,064	4,732,803
Ditto, exceeding 250 h.p. ..	136,679	106,422	1,236,491	956,350
Ditto, parts	103,241	126,832	1,183,376	1,835,979
Converting machinery ..	26,315	9,332	488,298	427,598
Transformers, including coils	855,004	1,288,857	10,479,123	12,449,466
Mercury arc rectifiers ..	37,588	135,366	755,023	782,478
Motor starting and controlling gear	254,572	240,135	2,808,426	2,793,043
Switchgear and switchboards (not telegraph and telephone)	1,311,461	1,329,991	15,499,882	16,096,732
Electrical machinery, n.e.s.†	427,612	46,795	4,184,990	976,818
Washing machines (not exceeding 150 lb weight)* ..	364,208	372,044	5,320,555	2,946,515
Ditto (over 150 lb but not exceeding 250 lb weight)* ..		161,724		1,207,465
Ditto, parts	38,649	75,266	325,884	461,239
Vacuum cleaners	151,464	149,197	1,911,635	1,499,881
Ditto, parts	23,004	34,123	374,343	308,815
Other electrically operated portable appliances ..	107,364	177,397	2,415,428	2,168,446
Portable electric tools ..	98,814	131,076	1,349,078	1,348,126
Electrical pottery and glassware, including insulators..	105,562	66,938	1,246,658	936,813
Electrical conduit tubes and cased tubes	61,718	67,995	543,997	903,783
TOTAL	15,293,210	15,118,228	185,038,815	175,802,317

* Not separately distinguished in 1952. † The figures are not comparable.

TABLE II.—DISTRIBUTION OF ELECTRICAL GOODS AND APPARATUS

Destination	Dec., 1952	Dec., 1953	Year 1952	Year 1953	Destination	Dec., 1952	Dec., 1953	Year 1952	Year 1953
	£	£	£	£		£	£	£	£
Channel Islands	58,040	31,055	457,872	401,672	Belgium ..	135,210	168,379	1,685,339	2,508,291
Gibraltar ..	6,989	38,015	228,871	183,348	France	118,430	170,733	1,130,102	1,954,716
Malta and Gozo	15,476	28,348	176,862	272,234	Switzerland ..	68,412	47,266	609,400	550,807
Cyprus	17,353	30,429	352,934	447,083	Portugal ..	67,829	101,571	1,118,616	1,119,890
Gold Coast ..	79,124	51,692	733,124	816,797	Spain	83,516	50,103	723,592	797,158
Nigeria	77,565	119,311	1,276,974	1,592,878	Italy	144,767	164,184	1,180,675	1,938,566
Union of South Africa	666,030	677,101	9,968,593	9,885,517	Austria	54,570	81,705	392,346	570,690
Northern Rhodesia	33,458	35,136	779,550	611,756	Czechoslovakia	8,555	16,903	130,533	64,402
Southern Rhodesia	114,866	109,045	1,993,234	1,423,209	Yugoslavia ..	63,622	52,094	506,348	438,689
British East Africa	198,668	223,057	2,638,595	2,730,337	Greece	37,808	31,526	958,698	508,312
Bahrein, Qatar and Trucial Oman..	44,055	19,462	419,040	729,743	Turkey	120,316	32,827	2,105,499	813,812
Kuwait	54,575	46,080	604,120	1,029,873	Portuguese East Africa	12,361	14,040	184,046	130,137
India	1,217,308	470,060	11,392,845	10,509,391	Syria	29,750	39,508	213,630	201,236
Pakistan ..	164,177	707,211	2,710,275	2,702,886	Lebanon ..	38,035	14,821	464,908	295,478
Malaya	411,004	232,714	4,446,943	4,112,800	Israel	40,306	16,811	516,703	538,075
Ceylon	108,108	95,370	1,250,717	1,362,232	Egypt	148,558	93,506	1,938,318	1,029,323
Hong Kong ..	113,128	161,441	2,052,318	1,552,146	Arabia	22,466	46,143	341,293	369,599
Australia ..	720,396	575,779	9,426,207	7,078,593	Iraq	153,590	145,170	1,477,113	1,682,651
New Zealand ..	423,308	568,367	7,239,938	6,634,922	Iran	14,313	24,189	204,032	197,365
Canada	164,931	257,387	3,053,410	3,711,441	Burma	71,691	83,864	876,398	1,002,808
British West Indies	198,977	201,621	1,568,430	1,482,693	Thailand ..	67,806	16,251	686,767	640,441
Anglo-Egyptian Sudan	150,439	71,041	834,486	919,497	Indonesia ..	141,163	25,948	835,687	541,253
Other Commonwealth Countries	192,492	153,510	1,565,394	2,789,106	China	1,151	22,572	42,153	111,604
Irish Republic ..	285,058	199,204	3,552,294	2,474,241	United States of America ..	90,795	124,390	1,187,476	1,452,608
Soviet Union ..	35,912	345,863	279,040	1,121,380	Colombia ..	52,215	30,986	707,133	287,132
Finland ..	49,578	34,011	1,147,055	384,595	Venezuela ..	144,790	98,302	1,090,044	1,086,686
Sweden ..	162,746	243,492	3,555,283	2,983,434	Peru	25,347	30,030	378,784	310,286
Norway ..	94,475	248,941	1,792,944	1,935,751	Chile	33,853	28,628	396,100	316,128
Iceland	16,227	15,841	161,136	127,755	Brazil	198,031	38,509	2,332,602	606,573
Denmark ..	53,682	78,436	1,066,510	984,782	Uruguay ..	2,346	44,004	219,388	184,452
Poland	18,629	43,726	227,050	268,495	Argentine Republic	11,884	133,618	1,093,230	757,543
Western Germany	54,618	49,682	734,125	771,210	Other Foreign Countries ..	236,921	231,107	3,347,044	3,824,062
Netherlands ..	229,354	270,290	2,940,577	2,974,369	Total ..	8,671,153	8,652,406	109,700,743	103,840,939

these rise last year by over £3 million, but last year's figure was nearly twice that of 1951. Against this there was a decline in the demand for domestic radio sets, though taking radio, telegraph and telephone equipment as a whole last year's exports show an improvement on 1952.

Cable exports, which were especially good in 1952, last year lost some of the ground gained, falling from £32,169,059 to £29,411,187. The demand for the paper-insulated kind was, however, maintained.

Of all the classes of goods and apparatus the one showing the greatest proportionate reduction was cooking appliances, exports of which were worth only half as much as in 1952. This was mainly the result of reduced purchases by Australia. The fall occurred in the earlier months of the year and it is satisfactory to notice that for the last quarter the 1952 figures were exceeded.

Turning to the machinery section, the demand for generating plant was maintained at about the level of the previous year (£16·8 million against £16·9 million). Australia was the principal buyer with £2,219,866 worth (against £2,803,578), followed by Canada, £1,657,756 (£1,628,343), India, £1,504,583 (£1,236,020) and South Africa, £1,296,712 (£1,047,268). Reduced purchases, notably by Brazil £184,103 (against £603,158), Argentina £58,853 (£273,358), Russia £177,664 (£311,579) and Ireland £111,040 (£362,224), were made good by increases in the case of Norway £587,759 (£297,028), the Netherlands £523,313 (£364,223) and unspecified foreign countries £3,632,076 (£2,841,988).

Exports of motors and parts aggregated £9·8 million against £10·7 million and of switchgear, transformers, etc., £33·5 million against £34·2 million. In the case of transformers there was an increase on the year of nearly £2 million to a total of £12·4 million following a similar improvement in 1952.

Table II gives details of the exports of goods and apparatus (i.e., excluding machinery) according to countries. It will be seen that India remained the chief market, followed by South Africa, Australia and New Zealand. Exports to Canada increased by £658,031 to £3,711,441 and to the United States by £265,132 to £1,452,608.

Imports of electrical goods and apparatus amounted to £7,729,288 against £7,764,345. These came mainly from the Netherlands (£2,891,135 against £2,248,453 in 1952) and the United States (£1,419,221 against £1,087,346). Electrical machinery imports were as follows:—Generators, £388,447 (£466,752); motors, £599,228 (£531,709); and other sorts, £889,074 (£321,460).

Physical Society Exhibition

THE thirty-eighth annual exhibition of the Physical Society will be held at the Imperial College of Science and Technology, Imperial Institute Road, London, S.W.7, from Thursday, 8th April to Tuesday, 13th April. The exhibition will be held wholly in the Physics and Chemistry Departments of the College, which should be of great convenience to visitors.

Arrangements for issuing tickets have been greatly simplified and applications for tickets should be made to the secretary-editor at the offices of the Society, 1, Lowther Gardens, Prince Consort Road, London, S.W.7. Tickets will not be sent out until the beginning of March, and no order can be acknowledged unless a stamped addressed postcard is also enclosed.

Extreme pressure on space has made the exhibition slightly smaller than that of previous years, but this reduction is amply compensated for by the high standard of the exhibits. As in previous years the comprehensive handbook of the exhibition will be available at the exhibition and copies can be obtained from the secretary-editor at the above address, price 6s (by post 7s 3d).

Large-Scale Catering

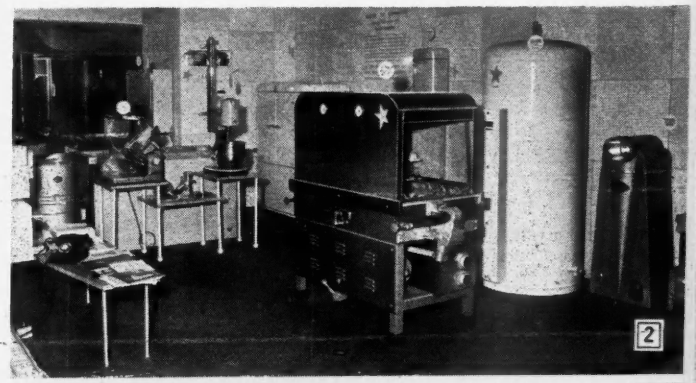
Wide Variety of Electrical Labour-Saving Appliances Displayed at Olympia

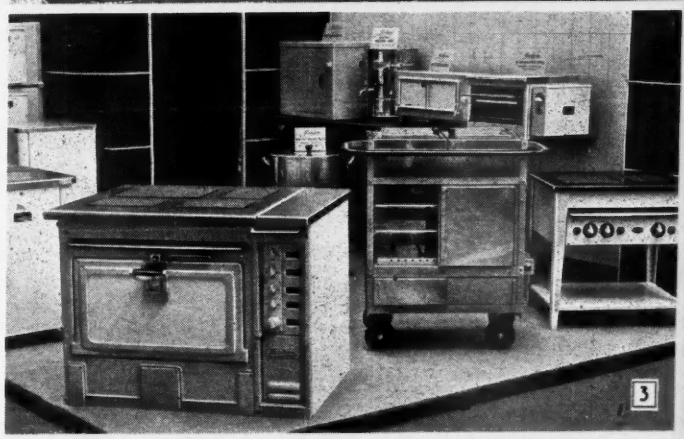
DESPITE the inconveniences of the electricians' strike which left many of the stands without electricity for lighting or demonstrating appliances, the Hotel and Catering Exhibition, which is being held at Olympia, London, until this evening, is, from the electrical point of view, the best display of its kind yet held. A very high proportion of the 250 stands are devoted to electrical apparatus, which includes a remarkably large number of new or improved models. Especially noteworthy is the attention which manufacturers have paid to robustness of design to enable apparatus to withstand the hard use which it is likely to encounter. Particular care has been taken in the matter of appearance.

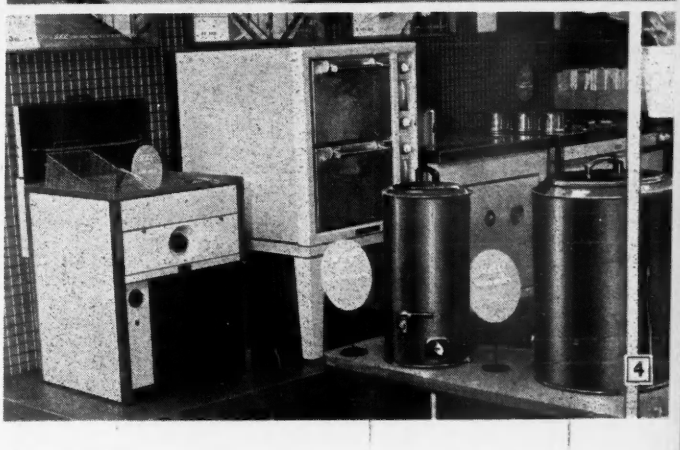
Efficiency and hygiene in the kitchen are important aspects of the catering business and this forms the theme of the Electrical Development Association's exhibits. These include a new Hobart dish washer for 2,700 dinner plates or 5,400 cups an hour; a Stott sterilizer; a Simplex 100 gal storage heater and a Berry's 3 gal over-the-sink heater; a Jackson incinerator and the "Handy Andy" hand dryer; the Hoover "Glassmaster"; a Hobart potato peeler and slicer; the Peerless "Baby" mixer with various attachments; a Frigidaire refrigerator; a bain marie and a combined unit oven and boiling table (G.E.C.); a grill on a stand (Jackson); a Simplex fish fryer; and a Santon water boiler for use in cafés and restaurants.

A new single-pan fish fryer and an industrial coffee percolator (1 or 3 gal) are among a selection from the General Electric Co.'s complete range of cooking apparatus for the small and large industrial kitchen. A cooking range also shown can be built up into multi-oven units. Other cooking equipment includes a hotcupboard with a separately heated service top, a small grill, a pastry oven and water boilers. Among auxiliary equipment for the hotel are a vacuum cleaner, polisher, slot meter fire, "Xpelair" and pedestal fans, a "Nightstor" thermal storage space heater, a 100 gal storage water heater, and fluorescent and contemporary tungsten lighting fittings.

On the Jackson Electric Stove Company's stand is a representative selection of cooking apparatus for both large and small kitchens of hotels, restaurants, canteens,

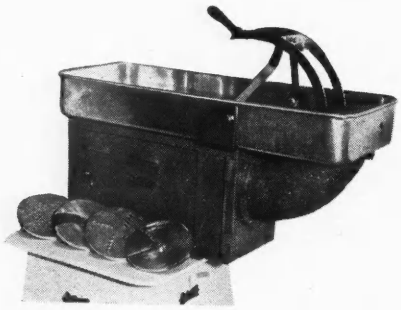




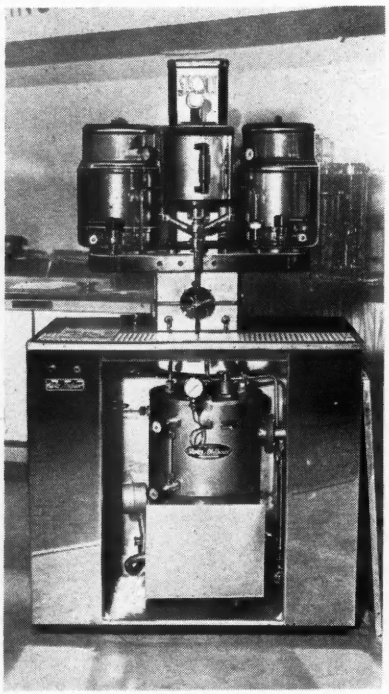


(1) Gardiner & Gulland back-bar equipment. (2) The E.D.A. stand showing the new Hobart dish washer in the foreground. (3) Jackson chef's range, hospital food trolley and boiling table. (4) G.E.C. fish fryer, pastry oven and coffee percolator

Left: Crypto " Rotapan " steam cooker and 80 and 40 qt mixers. Right: Prototype of Simplex " Creda " chef's range with solid top hotplate



C. B. Metcalfe vegetable preparing machine



Stott " Connoisseur " café set

clubs and hospitals. Lack of electrical facilities interfered with arrangements made for advanced students of the Acton Technical College to demonstrate the versatility of the two-deck pastry oven. To show how kitchens can be attractive and pleasant to work in, as well as efficient, all of the equipment is in cream vitreous enamel. It includes large and small capacity hotcupboards, stand and bench model grills, a single oven, a multiple-plate-top chef's range, a twin ring boiling unit, a boiling table, a chromium plated vegetable boiling pan and water urn, and an electrically heated food trolley, as recently supplied to St. Bartholomew's Hospital.

In addition to " Creda " unit type ranges, roasting ovens, and boiling tables, of which over 2,500 have now been supplied, the Simplex Electric Co., Ltd., is showing its new steaming oven and the prototype of a new chef's range having a solid top with graduated heat zones.

Aluminium alloy hotplates with the heating elements cast in are a feature of the new No. 2331 range introduced by Carron Company, whose other new products include a grill mounted on legs with a shelf between, a two-tier baking oven, a hot closet and a fish fryer. The Falkirk Iron Co., Ltd., has a selection from its heavy duty cooking equipment. Examples of Benham & Son's apparatus comprise a heavy duty range and a double-deck general purpose oven specially suitable for schools, etc. A range designed for a ship's galley is shown by Moorwoods, Ltd. Claimed to reduce grilling time by 80 per cent, the " Turmix " infra-grill is available in four sizes from A. E. Warner (London), Ltd., who also show the new " Beerex " electric spits, a fully automatic fryer said to halve oil consumption, and a mixing machine.

Stainless steel jacketed boiling pans in 10, 20, 30 and 50 gal sizes are new products of Euk Catering Machinery, Ltd., whose exhibit includes bread slicers, automatic toasters (2, 12 and 24 slice), hotcupboards, bains marie, and fish fryers. Among a comprehensive display of Crypto equipment are " Rotapan " steam cookers, mixers, slicers, potato peelers and other vegetable preparation machines, water boilers, " Midget " counter fryers, coffee mills, hotcupboards, heated food trolleys, and hand and face dryers. The display of Frank V. Magrini, Ltd., includes food conveyors, glass coffee makers, automatic toasters, deep fat fryers and hotcupboards. A sandwich toaster is to be seen on the stand of Riservato Partners, Ltd., together with " Gaggia " coffee making equipment, coffee grinders and fruit juice extractors.

New items of food preparation equipment are particularly numerous. In addition to a 12½ qt mixer and an air whip machine, the Hobart Manufacturing Co., Ltd., has a new streamlined 30 qt model with a micro-switch gear-change arrangement. Peerless & Ericsson have brought out a 20 qt mixer with three-speed constant-mesh gears, a large mixer with a split foot permitting the bowl to be removed, a potato chipper with a cast aluminium body and a hotplate with a 4ft by 2ft plate area and a loading of 5½ kW, " Simmerstat " controlled. Swift & Swallow's No. 22 mincer has been redesigned to incorporate a number of improvements.

The new C. B. Metcalfe vegetable preparing machine is supplied with interchangeable plates for shredding, crumbing, chipping and slicing. The " Regina " potato peeler (7 lb capacity) accompanies the " S.A.

Peckmix " machine on Rowe Brothers' stand, a feature of which is an all-electric self-service counter produced by the company. The Avamore Engineering Co., Ltd., has potato peelers of from 7 lb to 35 lb capacity, while Medcalfe & Co. (1950), Ltd., besides a range of potato peelers, show vegetable cutters, slicers, mixers, etc. A full range of vegetable preparation machines is demonstrated by Kitchen Machines, Ltd.

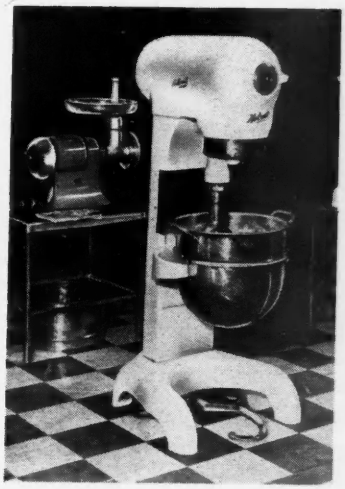
The recently introduced H.M.V. 6¼ qt food mixer is available with accessories for a variety of purposes, including coffee grinding. Similar facilities are provided by the new Kenwood 6 qt machine which is accompanied by the " Chef," the " Kenmix " liquidiser and the " Minor " portable mixer. Insulations & Constructions, Ltd., show " Cresta " food preparation equipment suitable for both large and small establishments.

With egg supplies now plentiful an automatic egg cooker made by W. M. Still & Sons, Ltd., is likely to be in demand. The same company has developed a new tea brewer (7½ kW or 15 kW), hotcupboards and a cup scrubber with nylon brushes. James Stott & Co. (Engineers), Ltd., have redesigned their water boilers and café sets. The new " Connoisseur " pressure set, with an output of 225 pints of boiling water an hour, is fitted with six 2 kW immersion heaters and a 500 W immersion heater which also serves as an automatic cut-out in case of low water level. On the same stand can be seen the " Newpost " water boiler designed for canteens where large supplies are required in a short time, hotcupboards, boiling pans, service counters and an ironing machine.

A wide variety of tea and coffee making apparatus is demonstrated by Minimax, Ltd., Hodgkison & Co., and Jackson Boilers, Ltd. With the aid of a cut-away model, the last-mentioned company draws special attention to its self-feeding boiler which is the basis of all its designs. Automatically controlled and giving a continuous flow of positively boiling water, this apparatus is available in all sizes, with or without " Pyrex " lined milk and coffee containers incorporating the " Filtomaton " system. Also on view are the Jackson café fountain set; the " Teatomaton " master tea brewer, which combines boiler, tea infusers and containers within one chromium or copper casing; a new automatic milk heater, an independent unit available in 12 to 32 pint capacities; and a new two-flask glass coffee maker. The Cona Coffee Machine Co. shows a number of different types of its coffee making apparatus.

Representing its range of water heating equipment, Santon, Ltd., has on show immersion heaters of from 1 kW to 9 kW loading, thermal storage heaters, a 60 pint/hr water boiler, a 12 kW steam raiser, a flow type water heater, available with loadings from 12 kW to 90 kW, and the " Hotsprings " shower cabinet.

A display of back-bar equipment arranged by Gardiner & Gulland, Ltd., includes a new " Saladaire " refrigerated unit; an " Alacarte " hotcupboard; a call-order unit with griddle, deep fat fryer and exhaust fan over; and a refrigerated cupboard section. A variety of different top arrangements is provided by the bridging bars employed in a new " Alacarte " unit. The " Sunglow " overhead infra-red unit for counter serving, a sundae display cabinet, a two-tier cabinet type hotcupboard and hospital food conveyors are other interesting items. Food conveyors are also prominent among the displays of Oliver Tom's Catering Equipment and G. F. E. Bartlett & Son, Ltd., the type displayed by the latter company being a particularly inexpensive hospital diet model.

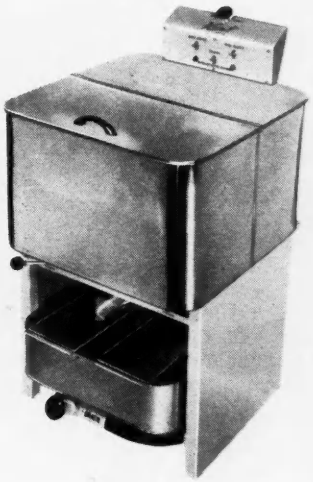


Hobart 30 qt mixer

Carron baking oven

" Prestcold " S.C.175 service cabinet

Rowe Bros. " Regina " potato peeler

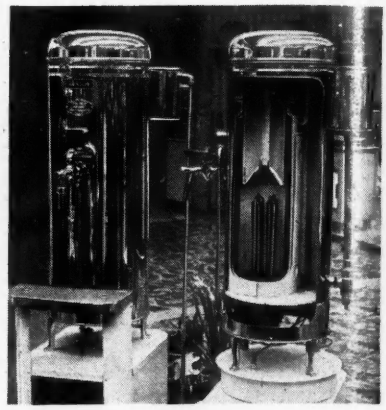


" Kent " dish washer (Max Arc & Electrics, Ltd.)

Among refrigeration equipment Prestcold include two new service cabinets (models SC175 and SC176), a closed display cabinet, a fish cabinet, a conservator for frozen food or ice cream, a tallboy wine and hors d'œuvres cabinet and 3, 5 and 7 cu ft domestic models. An 8 cu ft bottle cooler taking 132 half-pint bottles is conspicuous on the Lightfoot stand, while Insulations and Constructions, Ltd., make a feature of their $1\frac{1}{2}$ and 4 cu ft domestic refrigerators for building in. Besides service and display cabinets and domestic units Nash-Kelvinator, Ltd., draw attention to complete refrigeration systems for special applications. The method of operation of the "Frostmaster" automatic defrosting system is demonstrated on the Frigidaire stand, where there can also be seen the "Ice-matic" ice cream vending machine. A similar machine is among the Peerless & Ericsson exhibits. Drink vending machines are shown by Automat Sales.

In addition to three dish washing machines for 100 to 1,000 people an hour Dawson Bros., Ltd., display automatic glass washing machines, including a new 30 glass/min model. A new "Kent" dish washer shown by Max Arc & Electrics, Ltd., is designed for establishments handling up to 100 meals an hour. It is completely self-contained, incorporating reservoir tanks, immersion heaters and water pressure pump. It is especially suitable where space is limited. Other dish washing plant is shown by Leonard Hall & Co., Staines Kitchen Equipment Co., Ltd., Arcason Products, Ltd., W. H. Paul, Ltd., and the Avamore Engineering Co., Ltd.

Floor cleaning apparatus of many kinds is exhibited by the Columbus-Dixon Organization. Hoover, Ltd., shows both heavy duty vacuum cleaners, the new cylinder model and floor polishers. Carpet cleaning *in situ* is possible with the aid of the "Electralave" machine appearing on the Shepherd's Aerosols stand.



Jackson Boilers boiler, cut-away to show method of construction

Intercommunication telephones, microphones, luminous signals, room call pushes, maids' portable buzzers, razor plugs and sockets, and electric locks are all shown by Sterdy Telephones, Ltd. The "Radiotel" equipment (Sound Diffusion, Ltd.) provides both radio and personal intercommunication between host and guest, a central indication system being incorporated if desired to record once every twenty-four hours the numbers of rooms in which the radio has been used.

ELECTRICAL BREAKDOWN OF GASES

IN a lecture to the Bristol Students Section of the Institution of Electrical Engineers, Dr. C. Grey Morgan (University College of Swansea) discussed the mechanism of the transition of a gas from almost perfect insulator to almost perfect conductor owing to the application of an electric field.

In its three broad aspects (sparks at low pressures of 10^{-2} atm or less, sparks at atmospheric pressure, and breakdowns under very high electric fields in highly compressed gases), he said, the mechanisms at first sight appeared to be so different that different theories had been proposed to account for them. However, recent investigations at Swansea under Professor F. Llewellyn Jones had shown that there were basic principles common to all three aspects and that a unified theory was now possible. In this theory the essential feature was the continuous development of a primary electron avalanche from behind by one or more of a number of possible secondary ionization processes which were effective when moving towards the cathode and most efficient when acting at the cathode. A knowledge of the primary and secondary ionization coefficients permitted accurate prediction of sparking potentials under given conditions.

At low pressures, about 10^{-3} to 10^{-1} atm, involving voltages between a few hundreds and a few thousands, the mechanism and rate of development of breakdown was largely controlled by the nature and geometry of the cathode. Changes in the secondary processes resulting in large changes in the sparking potential were caused by altering either the cathode surface or its geometry, for example, by the removal of thin oxide and tarnish layers, which were present on surfaces which had been exposed to the atmosphere, or by the sputtering of cathode material.

Precision measurements made at Swansea of the growth of ionization in uniform electric fields in discharge gaps in the atmosphere had shown that at higher pressures, too, breakdown was controlled by primary and secondary ionization processes, and not, as was once thought, caused by the sudden appearance of some entirely new mechanism dependent upon the formation of space charges. This meant that from a knowledge of the measured primary and secondary ionization coefficients, sparking potentials could now be precisely predicted without reference to an arbitrary but elastic constant in an empirical equation which apparently had no physical significance.

In compressed gases breakdown occurred at high (10^4 to 10^5 V/cm) electric fields. In these conditions considerably enhanced electron extraction took place from the cathode under the influence of an electric field. This emission was greatly influenced by the presence of dust, tarnish layers and surface finish and played an important role in the initiation of discharges in spark ignition apparatus. It would be regarded as an enhanced secondary emission process so that the theory of breakdown could be generalized to include field emission. Since it depended only upon the value of the electric field and not upon the ratio of the electric field to gas pressure it accounted for the observed failure of Paschen's Law in compressed gases. Again, in electrical contacts and micro-switches and relays the breakdown mechanism involved this field emission which might be further intensified by the presence of positive ions on contaminating surface layers. This work showed the important role played by electrode surfaces over the whole range of breakdown phenomena.

Supplies to County Council

THE North Eastern Electricity Consultative Council, at a meeting at Newcastle-on-Tyne, considered a protest by North Riding County Council against the Electricity Board's new method for charging for electricity used in Council buildings at Northallerton. For many years the County Council had an arrangement with the former North-Eastern Electric Supply Co., Ltd., whereby electricity was charged on a collective basis for all the Council buildings such as the County Hall, police station, court rooms, etc. The Board has introduced a new system under which these are classed as separate units. The Consultative Council pointed out that other large consumers were now on the new system and no discrimination could be made in favour of the North Riding County Council. Moreover, the County Council would pay only slightly more for its electricity than under the old method.

Representations on Bulk Supply Charge

It was stated at a meeting of the Midlands Electricity Consultative Council in Birmingham on 18th January that the Council had made representations directly to the Ministry of Fuel on changes in bulk supply tariffs. Alderman H. T. Bush, of Cheltenham, said that so far as the Midlands Electricity Board was concerned the revision would have the effect of adding £1,000,000 to electricity costs.

Distribution Transfer

The North Eastern Electricity Board is shortly to take over from the National Coal Board, the supply of electricity to the Witton Gilbert area and the supply will be changed from d.c. to a.c. The Rural Council has agreed to carry out rewiring where necessary and additional facilities for using electrical appliances will be provided.

Cooker Terms

The Southern Electricity Board is to be asked by the Consultative Council to review its present policy in respect of electric cookers with a view to improving the terms available to customers.

Estate Services

Longbenton (Northumberland) U.D.C. is to install electricity in 146 houses at a cost of £5,987.

Boldon (Co. Durham) U.D.C. has approved plans by the North Eastern Electricity Board for the laying of a 22 kV underground cable to provide a supply to 529 houses and other premises at West Simonside.

Cookers in Council Houses

Huntingdon R.D.C. is to install electric cookers in 24 Council houses at Sawtry and Alconbury instead of coal ranges and back boilers as originally proposed.

Ringway Airport Lighting

Manchester Corporation Airport Special Committee has authorized the preparation of a detailed scheme, upon which tenders can be invited, for the improvement of the lighting at Ringway Airport, at an estimated cost of about £6,600.

Rewiring of Children's Homes

Stoke-on-Trent Corporation is to apply for sanction to borrow £1,790 for the rewiring of the Penkhull Children's Homes.

Holy Island Scheme Delayed

Norham (Northumberland) Rural Council has been informed by the South East Scotland Electricity Board that the supply of electricity to Holy Island would be delayed for a considerable time.

Electricity Boards' Sales

The accompanying table analyses the sales of Area Boards for December last. The national figures show a decrease over December, 1952, of 0·3 per cent, but when corrected for weather and the number of effective working days, the increase is 6·1 per cent. The weather conditions were much warmer and there were more effective working days than in December, 1952.

OVERSEAS

New Malayan Power Station

The construction of a 30,000 kW steam generating station by the Malayan Central Electricity Board in Malacca will start this year. A consulting engineer from Britain has visited Penang to see the site investigation work being carried out there for the new $24 million power station, the planning of which is already well advanced. As an interim plan it is intended to install two 1,250 kW diesel-driven generators which will remain in service until the new main steam station has been completed. The latter will provide 20,000 kW in 1957 and the full output in 1960.

Dutch Hydro-Electric Station

A Dutch company is to erect a hydro-electric station on the Meuse near Linne in Limburg Province. It will serve the company's chemical works at Roermond. This, it is believed, will be the first time that electrical energy has been produced by water power from one of Holland's large rivers.

ELECTRICITY SENT OUT BY AREA BOARDS FOR THEIR CONSUMERS

Area Board	Totals for December (million kWh)			Twelve Months Ended 31st December (million kWh)		
	1952	1953	Inc. or Dec. %	1952	1953	Inc. or Dec. %
London	628·0	578·7	− 7·9	5,443·1	5,607·0	+ 3·0
South Eastern	351·0	330·7	− 6·0	3,137·3	3,312·2	+ 5·6
Southern	400·8	388·1	− 3·2	3,649·5	3,897·8	+ 6·8
South Western	189·3	190·2	+ 0·5	1,757·8	1,894·0	+ 7·7
Eastern	565·9	538·3	− 4·9	5,096·9	5,387·0	+ 5·7
East Midlands*	457·0	450·8	− 1·4	4,356·8	4,612·8	+ 5·9
Midlands*	609·5	618·5	+ 1·5	5,941·1	6,150·0	+ 3·5
South Wales*	297·0	324·5	+ 9·3	3,266·8	3,472·3	+ 6·3
Merseyside & N. Wales*	335·1	344·3	+ 2·7	3,377·6	3,450·8	+ 2·2
Yorkshire*	583·2	590·8	+ 1·3	5,757·8	6,017·5	+ 4·5
North Eastern*	348·0	345·6	− 0·7	3,508·6	3,617·6	+ 3·1
North Western*	651·5	672·8	+ 3·3	6,353·6	6,728·2	+ 5·9
South-East Scotland	135·6	139·2	+ 2·7	1,234·1	1,291·3	+ 4·6
South-West Scotland*	335·1	334·4	− 0·2	2,979·7	3,102·6	+ 4·1
Total all Area Boards	5,887·0	5,846·9	− 0·7	55,860·7	58,541·1	+ 4·8
Direct Supplies by Central Authority	66·3	86·1	+ 29·9	733·5	959·5	+ 30·8
Grand Total	5,953·3	5,933·0	− 0·3	56,594·2	59,500·6	+ 5·1
Mainly Industrial Areas*	3,616·4	3,681·7	+ 1·8	35,542·0	37,151·8	+ 4·5
Mainly Non-Industrial Areas	2,270·6	2,165·2	− 4·6	20,318·7	21,389·3	+ 5·3
Total Number of Effective Working Days	27·36	27·54				

* Those in which industrial consumers took over 50 per cent of the total sales in the preceding financial year.

Waikato River Resources

Construction of Fifth Major Station Begun

PRELIMINARY work has begun on a 63,000 kW hydro-electric station at Atiamuri. This will be the fifth of the planned chain of ten major stations on the Waikato River in the North Island of New Zealand between Lake Taupo and the sea. It is expected to be in commission in four to five years. The fourth station, Whakamaru, is well in hand and may be completed in 1955–56.

According to the *Evening Post* (Wellington), the Government had proposed that the Atiamuri dam, power-house and other related works should be built by overseas contractors, while the Ministry of Works was to have built a 50,000 kW station at Waipapa, below Maraetai. Discussion of the many factors involved led to the decision that the Ministry should carry out the construction at Atiamuri, the plans for which would be prepared by the British firm of consultants, Sir Alexander Gibb and Partners, and that the building of the Waipapa station should be postponed. A representative of the British firm has recently discussed details of the headworks with the Ministry and of the electrical machinery with the State Hydro-Electric Department.

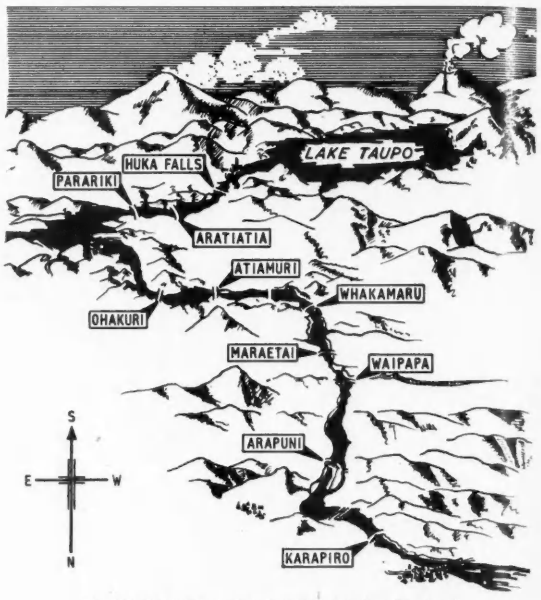
Contractors are now busy felling pines on the slopes of the river valley which will be flooded by the five-mile-long lake which will be formed when the dam is built. Two hundred single men will live at Atiamuri, but married men will have their homes at the " hydro town " of Mangakino and will travel to and fro by bus.

Soon after Christmas work started on the diversion channel which will carry the flow of the river out of its natural bed while the dam is being built across the rocky gorge, a few chains downstream from the traffic bridge on the Wairakei–Tirau highway. This bridge and a mile and a half of the highway will later be submerged, necessitating a considerable diversion of the highway and the building of a new bridge. The main dam structure will be about 500ft long, but on each side there will be wide-based earth dams covering comparatively light concrete " cut-off " walls as extensions of the dam proper and reaching down to solid rock foundation. The power-house, with three generating sets, will be built in the former river gorge, immediately downstream from the dam.

Large Gravity Dam

At Whakamaru, where 100,000 kW is to be developed, the dam is now taking shape. Although the power output will be much less than Maraetai's 180,000 kW, twice as much concrete is needed for the dam. The 400,000 ton dam is a gravity structure, whereas that at Maraetai, five miles downstream, is of the arched type.

A large concrete batching plant has been installed and is ready to begin the main pouring about next March. The present plant, which has been used for the initial pouring, has an output of 15 cu yd an hour, while the new plant can handle 80 cu yd an hour. Two aerial cableways, from which the concrete for the dam will be poured, stretch 1,200ft across the site. The pouring is automatic, as is the mixing of the concrete. Grades of rocks, pebbles and sands are separated into holding bins and blended, weighed and mixed with the concrete in a huge silo. The concrete face of the dam will stretch 1,000ft across the river, but two long earth wings which will carry the main road across the top of the dam will increase the lake's frontage to about 3,000ft. Whakamaru Lake will be the longest on the Waikato River, stretching back 17 miles to the foot of the projected Atiamuri dam. Maraetai Lake now reaches five miles to the foot of the Whakamaru. When the other Waikato schemes are completed the river will disappear as far as Karapiro. In its place will be a series of lakes stepping down like locks from Lake Taupo.



The Waikato River development in New Zealand

After Whakamaru the resources of the Waikato will allow for only one station of 100,000 kW (Ohakuri), and thereafter the power that can be drawn from the river will tail off:—Aratiatia, 60,000 kW; Waipapa, 50,000 kW; Huka Falls, 40,000 kW; and Pararíki, 20,000 kW. The *Evening News* comments that the full development of what just a few years ago seemed a widow's cruse of hydro power is thus only a couple of decades ahead.

From the Kaituna River, draining the Rotorua district lakes, and the Rangataiki River, 250,000 kW more may be generated, but after that the smaller stream resources of the North Island will be very limited and costly to develop. Fortunately there are still ahead the as yet unknown, but believed to be very great, possibilities of electric power generation in the geothermal country between Lake Taupo and the Bay of Plenty.

R.C.E.E.A. ANNUAL REPORT

THE annual report of the Radio Communication and Electronic Engineering Association states that exports of broadcast transmission, radio communication and navigational aid equipment have exceeded all previous figures, the annual rate in 1953 being just short of £11 million for direct exports, the value of indirect exports being estimated at £4 million. The comparative figures for 1952 were £8 million and £3 million respectively. There are now twenty-eight full member firms of the Association and advantage has already been taken of the recently-introduced associate membership.

NEW ELECTRICAL EQUIPMENT

Tumbler Switches

A NEW TYPE of "Lincoln" 5 A a.c. flush mounting tumbler switch has just been put on to the market by J. A. CRABTREE & CO., LTD., Lincoln Works, Walsall, Staffs, together with hardwood boxes of plaster depth, plaster depth steel boxes with bushed entries, grip steel boxes for use with either round or oval conduit, and deep steel knock-out boxes to accommodate considerable cable slack. The switch operates on the short-break principle and the small mechanism is protectively sealed against dust. Where two switches are required in one position they can both be mounted as a single unit in a one-gang extra-shallow or B.S. 1299 box.

Fused Rubber Plugs

The latest addition to the range of Sanders unbreakable plugs, first introduced in 1937 by WM. SANDERS & CO. (WEDNESBURY), LTD., Falcon Electrical Works, Wednesbury, Staffs, is a 13 A 3-pin fused plug in resilient rubber. Of robust construction, the plug (list No. UP313) is made in compliance with B.S. 1363, with the sole exception that the visible earth connection has been omitted in accordance with normal practice for unbreakable plugs. The retail price is 36s 8d per dozen.

Portable Conveyor Equipment

The combination of the "Loband" loader and improved "Hylo-veyor," manufactured by C. H. JOHNSON (MACHINERY), LTD., Adswood Road, Stockport, is suitable for the stockpiling of loose bulk materials brought to site in end tipping and telescopic lorries. The equipment eliminates the necessity for tipping on the ground and then piling with shovel or grab and the dangerous, laborious method of backing lorries up the pile. Both machines are highly mobile and can quickly be towed from one site to another. Tractors are not required to manœuvre the machines as the pile grows, as they can be easily manhandled.

The "Loband" loader can feed at any angle up to right angles around the "Hylo-veyor" hopper. This is a useful point in eliminating awkward approaches for the lorries. Rates of 260 tons per hour in coal and 100 tons per hour (400 cu yd) in coke are being obtained. One set of equipment is handling chrome ore up to 12in lumps with a density of 150 lb/cu ft. For this application the "Loband" loader has a special heavy hopper and belt, and shock absorbing idlers. This method of stacking has doubled the tonnage that could be stored by the previous method.

An unusual application for the "Loband" loader is at the B.E.A. Bold (Lancs) power station. It is being fed by bulldozer and in turn feeds a temporary conveyor up to the bunkers of the boiler house. This set-up is the sole intake for coal until the main intake conveyor from the colliery has been installed.

Potential Indicator

The "Neo-Maintest" potential indicator, now being manufactured by NEO ELECTRICAL INDUSTRIES, LTD., 87/89, Corporation Street, Manchester, 4, has been specially designed for vertical and horizontal switchgear and is suitable for all voltages up to 33 kV. The unit is completely insulated, being machined from black ebonite, and indication is given by a neon lamp fitted in the shaft.

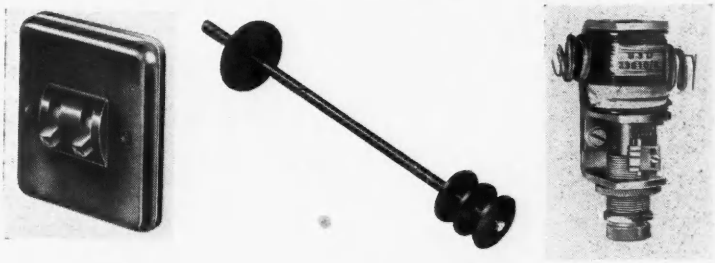
Motor Protection

A simple and effective overload trip relay has been developed by the GENERAL ELECTRIC CO., LTD., Magnet House, Kingsway, London, W.C.2, for use in control gear protecting motors driving high inertia loads. It will carry the heavy starting current over the relatively long time taken to accelerate the motor up to speed without risk of premature tripping or in any way prejudicing the normal overload protection of the machine.

The relay comprises a trip coil assembly, a screwed adaptor sleeve, an oil dashpot and an operating plunger assembly. On top of this plunger is an iron thimble which becomes saturated when the current exceeds a given value. As a result, increased current no longer gives rise to the normal strengthening of the magnetic pull and so tripping is delayed. The plunger stem and piston are made of duralumin so that any risk of the relay hovering in a midway position is avoided.

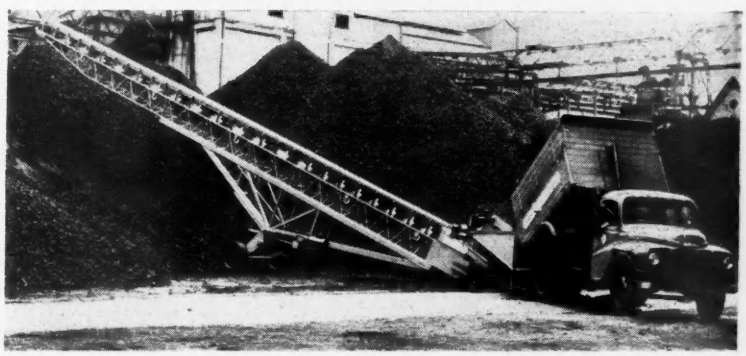
The combination of a dashpot and adaptor sleeve permits independent adjustment of the operating time and the overload setting. The latter is determined by the position of the adaptor sleeve into which the oil dashpot is screwed, while the operating time is governed by the position of the plunger within the dashpot.

The plunger assembly rests on a collar within the adaptor sleeve so that when the dashpot is fully screwed up the piston is immersed at the bottom of the pot, where the bore is reduced. As the dashpot is unscrewed it is lowered relative to the plunger assembly until the piston is clear of the restricted bore. The adjustment thus afforded enables the relay to be set for operating times ranging from instantaneous to a maximum of about 40 sec at ten times full load.



Left: "Lincoln" two-gang 5 A a.c. tumbler switch. Centre: "Neo-Maintest" potential indicator. Right: G.E.C. overload trip relay for protecting motors driving high inertia loads

A 62ft "Hylo-veyor" and "Loband" loader stockpiling coke to a height of 27ft



Financial Section

STOCKS and SHARES

FOR another week, the various developments in the field of industrial wages have acted as a damper on Stock Exchange activity. Nevertheless, prices have continued to stand their ground, and to make some headway here and there. Imperial Chemical Industries ordinary shares gave a notable performance in rising at one time to over 55s, the highest figure ever quoted for them. Several rumours, mostly connected with an issue in some form, accompanied the movement. Leading electrical engineering shares are satisfactorily maintained, while radio issues are dealt in fairly actively. In the gilt-edged market, prices have moved only by small fractions.

Price Changes

In the electrical equipment market, C. A. Parsons' shares came into the lead again with a rise of half-a-crown to over 40s. Enfields, London Electric Wire and Telegraph Constructions were 6d to 1s 6d better. Crabtrees and Midland Electric Manufacturing also moved up. H. J. Baldwin gained another 6d, while B.I.C., Wolf Electric and Strand Electric added to the improvements of the previous week. S. Smiths remained in favour. On the reverse side of the medal, Babcocks were quoted lower, and business in radio shares occasionally took the top off recent rises, losses of 3d to 1s being shown by Cossor, Ekco, E.M.I. and Plessey.

Shares on Offer

Among issues which have lately been available in fairly large lines, mention may be made of Aerialite 1s ordinary at about 12s. The yield is approximately 7½ per cent from the latest dividend of 88⅛ per cent. According to the chairman at the recent meeting, a very considerable increase in turnover has been achieved by the company in the first half of the year now running. Dewhurst & Partner's 2s shares have been offered in the market at 6s 1½d, to yield 6¼ per cent on the 19 per cent dividend. Christy Brothers £1 shares have been available at 21s 6d to yield 6½ per cent. In the lists of preference shares on offer, there were moderate amounts of the 7 per cent issues of Electric Construction and Atlas Electric, both offered at 27s 6d, and of G.E.C. 7½ per cents at 29s 6d, all of which pay a little over 5 per cent on the money.

Wireless Relay

The interim dividend of 5 per cent declared last week on the 5s "A" shares of British Relay Wireless & Television will be the first distribution to be made since the introduction of these shares to the market about six months ago. They have advanced steadily in popularity during the interval, the present price of 17s 6d being 5s or more above the level of early quotations. A total distribution of 16 per cent for the current year was indicated in the original prospectus. The Pye and Murphy companies are interested, both financially and technically, in the development of the radio

Week's Price Changes

Company or Board	Nom. Value	Middle price 25th Jan.	Week's Rise or Fall	Dividend Previous	Dividend Last	Yield %	1953 Highest	1953 Lowest
						£ s d		
Gilt-edged Stocks								
Brit. Elec. 1968/73	100	90		3	3	3 6 9	90	83⅛
Brit. Elec. 1974/77	100	89		3	3	3 7 5	89	82
Brit. Elec. 1976/79	100	94		3½	3½	3 14 6	94⅜	88⅛
Brit. Elec. 1974/79	100	105		4¼	4¼	4 1 0	104	99¼
Overseas Electric Supply								
Calcutta Elec.	£1	19/-		6†	6†	6 6 4†	21/-	18/-
East African Power	£1	21/6	−6d	7	7	6 10 3	25/-	20/9
Nigerian Elec.	£1	24/6		10	10	8 3 4	25/-	21/6
Palestine Elec. "A"	£1	17/6		Nil	Nil	Nil	19/3	7/7
Perak Hydro-Elec.	£1	15/-	+1/6	Nil	6	8 0 0	17/10	13/6
Equipment and Manufacturing								
Aberdare Cables	5/-	8/6	−3d	20	25	7 7 0*	8/9	7/4
Aerialite	1/-	11/9	−3d	88⅛	88⅛	7 10 3	11/6	8/1
Allen, W .H.	£1	50/-		15	15	6 0 0	51/-	42/10
Aron Elec. Ord.	£1	43/9		15	20	9 2 9	47/6	36/3
Assoc. Elec. Ord.	£1	44/3	+6d	20	20	4 10 6	45/7	36/4
Automatic Tel & El.	£1	65/-		15	15	4 12 4	65/3	55/-
Babcock & Wilcox	£1	48/3	−1/9	18	18	—	50/-	40/4
Baldwin, H. J.	2/-	5/3	+6d	20	20	7 12 6	4/1	3/-
Bakelite	10/-	25/6		—	12½	4 18 0	24/9	16/-
British Aluminium	£1	36/6	−6d	12	12	6 11 6	43/10	35/-
B.I. Callender's	£1	39/3		9	10	5 2 0	40/10	33/3
B.I. Callender's 6% Pref.	£1	25/6	+6d	6	6	4 14 10	26/3	23/-
British Thermostat	5/-	17/6		30	35	—	19/-	14/-
British Vac. Cleaner	5/-	13/9	+1/3	25	25	9 1 9	16/6	11/-
Brook Motors	10/-	31/6		20	20*	6 7 0	37/-	27/10
Brush Ord.	5/-	4/3	+3d	10	4	—	5/4	2/11
A. F. Bulgin	1/-	3/3		30	30	9 4 6	3/5	2/6
Burco	5/-	12/9		35	35	6 17 3*	12/2	8/6
Chloride El. Storage	£1	47/6	−9d	15	20	4 4 3*	44/10	32/3
Clarke Chapman	£1	73/9		15	17½	4 15 0	70/6	57/6
Cole, E. K.	5/-	23/3	−6d	25	25*	5 7 6	23/9	14/2
Cossor, A. C.	5/-	7/6	−6d	10	10	6 13 3	11/4	6/4
Crabtree	10/-	27/-	+2/-	17½	17½	6 9 8	32/6	23/9
Crompton Parkinson Ord.	5/-	14/6		11¼	20	6 18 0	16/-	8/7
De La Rue	5/-	13/-	−6d	35	Nil	Nil	14/6	6/3
Decca	5/-	37/6		112½	150	4 1 0*	37/9	17/6
Desoutter	5/-	16/9		16	18	5 7 6	17/6	14/3
Dewhurst	2/-	6/-	−3d	19	19	6 6 8	6/9	5/-
Dictograph Tel.	2/-	5/4½	−1½d	20	20*	7 9 0	5/10	3/10
Dubilier Condenser	1/-	4/3		28	25*	5 17 9	4/4	2/10
E.M.I.	10/-	12/9	−3d	12	8	6 5 6	15/3	11/6
Electrical Components	5/-	12/-		20	20	8 6 8	12/-	9/3
Elec. Construction	£1	53/9		15	15	5 11 9	56/-	50/6
Enfield Cable Ord.	£1	20/6	+1/-	7½	5	4 17 6	24/10	17/-
English Electric	£1	49/9		15	15	—	40/8	34/-
English Electric 3½% Pref.	£1	16/-		3½	3½	4 13 9	16/4	14/6
Ericsson Tel.	5/-	43/9	+9d	22†	22†*	2 5 2†	48/9	36/-
Ever Ready	5/-	26/6	−9d	35	35	6 12 1	29/-	25/-
Falk Stadelmann	£1	38/3		15	15	7 16 10	44/3	33/3
G.E.C. Ord.	£1	40/-		22½	11¼*	5 12 6	46/-	36/3
G.E.C. 6¼% Pref.	£1	27/-		6¼	6¼	4 16 3	27/7	24/9
General Cables	5/-	16/9		30	30	8 19 2	17/-	14/9
Greenwood & Batley	£1	42/-		15	17½	8 6 9	41/6	33/-
Hackbridge Cable	5/-	11/9		20	20	8 10 3	13/-	10/4
Hackbridge & Hewittic	5/-	17/-	−6d	20	20	5 17 8	18/3	16/1
Hall Tel. Acc.	10/-	11/6		10	10	8 14 0	12/7	8/6
Heatrae	2/-	4/-	+3d	12½	12½	6 5 0	4/3	3/3
Henley's	10/-	16/3	−6d	20	10½*	6 9 3	19/4	16/-
Holophane	5/-	13/9		20	20	7 5 6	13/9	11/1

* After capital bonus. † Free of income tax.

The above quotations are based upon middle prices in the Stock Exchange Daily Official List.

and television relay systems operated by the enterprise. Their shares are also a strong market these days, Pye 5s deferred having risen 1s 6d during the past week to 17s 6d (ex the one-for-two share bonus), and Murphy 5s ordinary being 8s 6d. The latter's dividend for 1953 will be due first, in April.

British Electric Traction

British Electric Traction 5s deferred shares have been receiving a considerable amount of attention lately at prices around 40s 6d. One reason for this has been the distribution of capital bonuses, in the form of preference shares, by two of the group's principal transport subsidiaries. It is calculated that B.E.T. receives, as a result, marketable securities to the value of upwards of £3½ million, which could presumably be of material use in furthering the company's various investment plans. This, at least, is the deduction drawn in the market, where the possibility of an increase in the next final dividend is being freely canvassed; the interim for the current year already has been raised.

in Electrical Investments

Company or Board	Nom. Value	Middle price 25th Jan.	Week's Rise or Fall	Dividend Previous	Dividend Last	Yield % £ s d	1953 Highest	1953 Lowest
Equipment and Manufacturing—continued.								
Hoover	5/-	26/9	−6d	35	25	4 13 6	26/10	20/3
I.C.I.	£1	54/9	+3d	13	13	4 15 0	54/-	41/6
Intl. Combustion	5/-	14/9	−3d	25	15*	5 1 9	15/6	12/1
Johnson & Phillips	£1	50/6	+6d	15	15	5 18 3	59/3	49/-
Lancashire Dynamo	£1	43/9		12½	12½	5 14 3	47/-	41/-
Laurence, Scott	5/-	13/9		15	15	5 9 0	14/6	11/9
Lister, R. A.	£1	32/-		9	9	5 12 6	34/3	27/9
London Elec. Wire	£1	40/-	+1/6	12½	15	3 15 0*	38/3	26/-
J. Lucas	£1	52/-		9½	10½	4 3 4	51/3	35/6
Marryat & Scott	2/-	5/3		22½	22½	8 11 6	6/3	5/1
Mather & Platt	£1	53/6		12½	15	5 12 3	53/10	41/3
Metal Industries	£1	40/-	−1/9	15	12*	6 0 0	47/9	37/9
Midland Elec. Mfg.	£1	63/9	+1/3	15	15	4 14 0	63/9	56/3
Morphy Richards	4/-	19/-		40	40	8 8 6	16/3	13/-
Murex	£1	52/6		15	15	5 14 3	60/9	50/6
Newman Ind.	2/-	2/6		10	10	8 0 0	2/10	2/-
Oldham & Son	1/-	2/9		35	17½*	6 7 3	2/10	2/2
Parnall (Yate)	5/-	5/-	−3d	6	6	6 0 0	4/9	2/6
Parsons, C. A.	£1	40/9	+2/6	10*	12½	—	48/-	27/9
Plessey	5/-	39/-	−1/-	25	30	3 17 0	37/-	20/1
Pye Deferred	5/-	17/6	+1/6	18	20	—	16/3	10/6
Revo	10/-	17/3	+3d	27½	27½	—	17/6	13/11
Reyrolle	£1	67/6		10*	12½	—	79/-	51/-
Rheostatic	4/-	11/-		16½	19	6 18 0	12/-	8/-
Richardsons Westgarth	5/-	9/3		12	15	8 2 3	11/1	8/6
Scottish Cable	4/-	13/3		32	20*	6 0 9	13/3	11/1
Siemens Ord.	£1	36/-		10	10	5 11 0	37/-	31/6
S. Smith (England)	4/-	12/9	+3d	12½	15	4 14 0	12/6	7/11
Southern Areas	£1	18/6		5	6	6 9 9	19/7	10/3
Strand Elec.	5/-	8/9	+9d	17½	17½	10 0 0	10/-	7/9
Sturtevant	5/-	32/-		17½††	18·1†*	—	29/9	20/10
Sun Elec.	£1	25/-		15	15	12 0 0	27/-	24/6
Switchgear & Cowans	5/-	12/6		22½	22½	9 0 0	16/9	12/6
Taylor, T.	5/-	12/3		20	25	5 2 0*	12/3	9/6
T.C.C.	10/-	42/6		20	20*	—	42/6	31/5
T.C. & M.	£1	32/6	+1/-	10	8½*	5 4 7	31/6	25/6
Telephone Mfg.	5/-	7/6		10	10	6 13 3	9/4	7/1
Thorn Elec.	5/-	16/-		12½	12½	3 18 3	14/-	7/10
Thornycroft	£1	35/9		15	15	8 7 8	54/-	29/9
Tube Investments	£1	63/9	+6d	15*	15	4 14 0	71/9	54/-
Vactric	5/-	10/-	+1/16	Nil	Nil	Nil	10/3	3/6
Veritys	5/-	5/-		7½	10	10 0 0	5/4	4/1
Wallsall Conduits	4/-	46/3	+1/3	70	70*	6 4 6	47/6	43/9
Ward & Goldstone	5/-	43/9		45	45*	5 2 9	46/-	29/9
Watford	2/-	4/9		25	25	—	5/6	4/10
Westinghouse Brake	£1	63/9		14	15	4 14 0	64/-	51/3
West, Allen	5/-	12/9		15	15	5 17 9	14/4	10/3
Wolf Electric	5/-	13/-	+6d	—	15	5 15 6	12/8	9/6
Trusts, Transport and Communications								
Anglo-Am. Tel.: A Ord.	100	83½		—	6	7 3 9	91	77
Ord.	100	52½		—	3¾	7 2 10	57½	53
Anglo-Portuguese	£1	22/3	+6d	8	8	7 3 9	23/9	20/1
Brit. Elec. Traction: Def. Ord.	5/-	40/6	+6d	25	35	4 6 0	39/6	21/3
Cable & Wireless: Ord.	100	148		8	8	5 8 1	148	124
4% Loan	100	97½		4	4	4 2 1	97¾	93
Calcutta Trams	£1	19/-	−3d	6†	2½†	—	23/6	16/-
Cape Elec. Trams	£1	13/-		5½	5½	8 9 3	13/-	9/-
Marconi Marine	£1	23/9		10	10	6 19 2	31/6	26/9
Oriental Tel. Ord.	£1	75/-		16	16	—	75/-	59/-
Telephone Props.	£1	4¾		8	8	—	126/3	33/-
Telephone Rentals	5/-	9/6		10	10*	—	10/-	6/8

Rheostatic

The Rheostatic Company is among the many companies which will be declaring final dividends and annual results for 1953 in two or three months' time. Last year, the total distribution was raised from 16½ to 19 per cent; the interim for the latest period was put up from 4 to 7½ per cent, with the intimation that this was being done only to spread the payment more evenly over the year, without necessarily indicating any change in the total. Subsequently, there were issues of both preference and ordinary shares, and a forecast from the company to the effect that earnings should be adequate to maintain the previous rate of dividend on the larger capital. Financial results in recent years have shown a persistently upward trend in earnings, and the net surplus of £74,000 for 1952 was sufficient to cover the ordinary distribution more than three times. The 4s shares are officially quoted at 11s, with the latest bargain recorded at 11s 6d, on which basis the yield works out at approximately 6¾ per cent.

Lindley Thompson Results

For the year ended last September, Lindley Thompson Transformer (Holdings) are paying an ordinary dividend of 12½ per cent, the rate also distributed a year ago, when the company published its first accounts since being made public. Trading profit is reported at £83,000, an increase of about 30 per cent. Taxation takes £5,000 more than before, but the company is able to write off the balance-sheet item for preliminary expenses and to increase the carry-forward by £9,000. Capital of the company consists of £100,000 in preference shares, and £230,000 in 1s ordinary shares. The latter have fluctuated narrowly around the par value since their introduction to the market in 1951, and changed hands recently up to 1s 2¼d (cum the dividend).

Redeemable Preference Shares

Preference shares carrying a fixed date for repayment of the capital being something of a rarity, attention may be called to Sterling Cable 4½ per cent preference, which come on offer

occasionally at about 18s 6d. The yield at that figure is £4 17s 3d per cent. They are to be repaid finally at 21s in 1982, or can be dealt with at the same price from 1958 onwards. Siemens 4 per cent redeemable preference are to be repaid at 21s in 1971, or earlier at 22s from 1957. They can be bought at 18s 9d to yield 4¼ per cent. Automatic Telephone also has a redeemable 4 per cent stock in issue, but repayment is at the company's option at any time, with no final date. The yield on the shares at about 16s 6d is correspondingly better, at £4 17s 0d per cent.

REPORTS and DIVIDENDS

The Westinghouse Brake & Signal Co., Ltd., held its annual meeting on 25th January, Capt. A. R. S. Nutting (chairman), presiding. In his circulated statement the chairman said that the increase in profits for the year under review was substantially due to the excellent results of their subsidiaries at home and abroad. Referring to the progress of the various divisions, Capt. Nutting said that the Signal and Colliery Division had secured the largest signalling contract placed in the past year by the British Railways. It had developed and supplied a completely new type of push-button control desk, and had completed the manufacture of the first installation to be made in Australia of centralized traffic control equipment. Through their associated companies, licensees and agents their Rectifier Division covered and led practically the whole world, and thus secured a valuable export business. Greatly increased interest in semi-conductors, which were the basis of their rectifiers, had been shown in a number of countries during the last year or two and this had necessitated expansion of their research in these substances. Much of the work in the Research and Development Department of the last few years was beginning to show results in improved electronic methods for accurately controlling the output of large rectifier equipments. They had also developed rectifiers for aircraft, and the present interest in a.c. systems of traction for electrification of railways had led them to develop new apparatus for signal systems operating on these principles.

Lindley Thompson Transformer (Holdings), Ltd., reports a trading profit for the year ended 30th September last of £82,618, as compared with £63,638 for the preceding year. Taxation requires £45,604, and preliminary expenses written off £5,000. The dividend for the year is maintained at 12½ per cent and £12,976 is carried forward (against £4,434 brought in).

New Companies

Barlow Bros. & Co., Ltd.—Registered 16th January. Capital £10,000. To acquire the business of electrical contractors carried on by Albert H. Neeld as Barlow Bros. & Co., at 5, Betterton Street, Drury Lane, W.C.2. Directors: A. H. Neeld, A. R. Field, A. E. Saunders, F. J. Thaxter, E. W. White and R. H. Young. Regd. office: 5, Betterton Street, W.C.2.

Bell's Asbestos and Engineering, Ltd.—Registered 1st January. Capital £100. The first directors are to be appointed by the subscribers. Regd. office: Bestobell Works, Slough, Bucks.

Atkinson, Son & Co., Ltd.—Registered 1st January. Capital £500. Manufacturers of and dealers in electrical appliances, fittings and equipment, etc. Directors: F V. Atkinson and Mrs. Constance E. Atkinson. Regd. office: 282, High Road, Willesden, N.W.10.

Granchy, Ltd.—Registered 7th January. Capital £100. Wholesalers of electrical equipment and components, etc. Directors: C. A. Carabott and G. J. Cassar. Regd. office: 6, Bedford Row, W.C.1.

Tulsevision, Ltd.—Registered 14th January. Capital £200. Retailers, wholesale and retail distributors, manufacturers, contractors, importers and exporters of and dealers in all kinds of apparatus for wireless telegraphy, etc. Directors: Mrs. Ulla E. Carlin and Mrs. Peggy C. Mortimer. Regd. office: 373, Norwood Road, S.E.27.

C. & S. Battery Accessories, Ltd.—Registered 14th January. Capital £1,000. Electrical, mechanical, radio and general engineers, etc. Directors: L. C. Swanes and K. C. Mullard. Regd. office: 4, Birds Lane, Lowestoft.

Increase of Capital

English Electric Co., Ltd.—Increased by £5,000,000, in £1 ordinary shares, beyond the registered capital of £10,000,000.

Liquidations

Mead Electric Co., Ltd.—Winding-up voluntarily. Liquidator, Mr. J. R. Mackenzie Valentine, of George A. Touche & Co., Suffolk House, Laurence Pountney Hill, London, E.C.4.

Castle Radios, Ltd.—Meeting 6th March at 52, Athol Street, Douglas, I. of M., to receive an account of the winding-up by the liquidator, Mr. T. C. Craige.

Bankruptcies

H. Brown, residing at 14, Abbey Drive, Luton, and lately carrying on business at 109a, Park Street, Luton, Beds, radio and electrical engineer.—Receiving order made 14th January on a creditor's petition.

C. W. Wainwright, 10, Victoria Row, Pudsey, Yorks, electrical engineer.—Receiving order made 20th January on a creditor's petition.

S. Green, 373, Bolton Road, Darwen, Lancs., electrical contractor.—Trustee, Mr. F. C. Ormrod, 20, Byrom Street, Manchester, 3, Official Receiver, released 18th January, 1954.

M. J. Ruddick, 89, Park Road, Wigan, Lancs., electrical appliance dealer.—Trustee, Mr. A. K. Ferguson, West Africa House, 25, Water Street, Liverpool, 2, Official Receiver, released 13th January, 1954.

TRADE MARK APPLICATIONS

APPLICATIONS have been made for the registration of the following trade marks. Objections may be entered up to 13th February:—

A-Z. No. B715,764, Class 9. Thermionic valve apparatus for use in sound amplification.—Sound Sales, Ltd., West Street, Farnham.

ALBAIN. No. 721,344, Class 9. Electrical conductors.—William Bain & Co., Ltd., Lochrin Iron Works, Coatbank Street, Coatbridge, Lanarkshire.

MOPAR. No. 717,158, Class 9. Electrical apparatus and instruments and parts and fittings therefor, all included in Class 9.—Chrysler Corporation, Detroit, Michigan, U.S.A. Address for service, c/o Stevens, Langner, Parry & Rollinson, 5–9, Quality Court, Chancery Lane, London, W.C.2.

No. 722,155 (design), Class 9. Electric batteries, cells and accumulators; radio apparatus operated by electric batteries, cells or accumulators; and cases for electric torches. No. 723,851 (design), Class 9. Bulb and battery testers, batteries, cells and accumulators; radio apparatus operated by electric batteries, cells or accumulators; and cases for electric torches.—Ever Ready Co. (Great Britain), Ltd., Hercules Place, London, N.7.

DIALCOM. No. 722,562, Class 9. Telephonic instruments and apparatus.—Modern Telephones (Great Britain), Ltd., 101, Tottenham Court Road, London, W.1.

NORVAC. No. 723,977, Class 9. Electric vacuum cleaners.—H. Morris and I. Morris, trading as Norvac Electrics, 14, Wheathill Street, Salford, 3.

AUTEST. No. 724,003, Class 9. Electrical testing apparatus.—W. A. Gold, 20, Gladsmuir Road, London, N.19.

GIMMICON. No. 724,052, Class 9. Electrical resistances; and condensers, suppressors, potentiometers and volume controls, all being electrical apparatus.—Erie Resistor, Ltd., 2, Carlisle Road, The Hyde, Hendon, London, N.W.9.

No. 723,952 (design), Class 9. Instruments, apparatus, systems and parts thereof for the production, transmission, reproduction, control, measurement or indication of signals of sound wave frequency, of carrier wave signals modulated at sound wave frequency or of television or other image signals.—Central Rediffusion Services, Ltd., Carlton House, Lower Regent Street, London, S.W.1.

VIBRON. No. 724,242, Class 9. Electronic measuring instruments.—Electronic Instruments, Ltd., 11–21, Red Lion Street, Richmond, Surrey.

MIXEND. No. 724,256, Class 9. Electrodes for electric welding.—Rockweld, Ltd., Commerce Way, Croydon, Surrey.

BENJAMIN-LEADER. No. B720,751, Class 11. Electric light fittings.—Benjamin Electric, Ltd., Brantwood Works, Brantwood Road, Tottenham, London, N.17.

BURNDEPT (design). No. 723,482, Class 11. Electric cooking stoves, electric clothes airers being parts of heating installations, electric torches, lamps for cycles and gas lighters.—Burndept, Ltd., 681, Salisbury House, Finsbury Circus and London Wall, E.C.2.

NEXT WEEK'S EVENTS

Organisers of electrical functions are advised to make use of the "Electrical Review" clearing house, Room 231, Dorset House, Stamford Street, London, S.E.1, to ascertain that proposed dates for their functions do not clash with others already arranged

Monday, 1st February

BIRMINGHAM.—James Watt Institute, Great Charles Street, 6 p.m. I.E.E. South Midland Centre. "A Recent Application of Diesel-electric Propulsion," by P. W. R. Gatliff. "Some Aspects of the French Distribution System," by K. Shaw. "The Production and Testing of Transistors," by J. Hughes. (Joint meeting with the South Midland Students' Section.)

BOLTON.—Balmoral Hotel, Bradshawgate, 7.30 p.m. A.S.E.E. Bolton Branch. "Electronics in Industries," by D. Gregson and P. McDonald.

CARDIFF.—Sophia Gardens Pavilion, 6.30 p.m. I.E.E. Western Centre. Faraday Lecture, "Electro-heat and Prosperity," by O. W. Humphreys.

CHESTER.—Town Hall, 6.30 p.m. I.E.E. Mersey and North Wales Centre. "Faster Than Thought," by Dr. B. V. Bowden. (Joint meeting with the North-Western Centre.)

ILFORD.—Angel Hotel, 8 p.m. A.S.E.E. North East London Branch. "The Photo-electric Cell," by D. H. Taylor.

LEEDS.—Great Northern Hotel, 7.30 p.m. A.S.E.E. Leeds Branch. "The Nature of the Universe," by W. L. Whittle.

LONDON.—Savoy Place, 6.30 p.m. I.E.E. London Students' Section. Students' Lecture. "An Outline of Television Systems," by Dr. R. L. Smith-Rose.

At the Geological Society, Burlington House, 5.30 p.m. Society of Engineers. Presidential address by W. R. Howard.

MAIDSTONE.—"Wig and Gown," 7.30 p.m. I.E.E. district meeting. "Design Features of Certain British Power Stations," by S. D. Whetman and A. E. Powell.

NEWCASTLE-UPON-TYNE.—King's College, 6.15 p.m. I.E.E. North-Eastern Radio and Measurements Group. "Telemetering for System Operation," by R. H. Dunn and C. H. Chambers.

Royal Turk's Head Hotel. North East Electrical Club. "Control and Protection of 3-phase Squirrel Cage Motors," by R. A. Forster.

NORWICH.—Royal Hotel, 7.30 p.m. I.E.E. district meeting. "Lightning," by Dr. R. H. Golde.

Tuesday, 2nd February

BRENTWOOD.—Eastern Electricity Board, 81–85, High Street, 4 p.m. E.I.B.A. Essex Branch. Meeting to reconstitute Branch Committee.

CAMBRIDGE.—Cambridgeshire Technical College, 6.30 p.m. I.E.E. East Midland Centre, district meeting. "Industrial Application of Radioactive Isotopes," by S. Jefferson.

DERBY.—Electricity Service Centre, 6.30 p.m. I.E.E. East Midland Centre. "New Lamps—New Uses and New Lighting Techniques," by R. V. Mills.

EDINBURGH.—25, Charlotte Square, 7 p.m. Incorporated Plant Engineers, Edinburgh Branch. "The Efficiency of a Modern Steam Plant," by H. E. Partridge.

HAMMERSMITH.—Windsor Castle Hotel, 134, King Street, 7.30 p.m. A.S.E.E. West London Branch. "Electrical Control Gear for Mechanical Handling Plant," by S. H. Harding.

LEEDS.—1, Whitehall Road, 6.30 p.m. I.E.E. North Midland Centre. "The Testing and Specification of Bushings in Relation to Service Conditions," by H. Barker and H. Davies.

LONDON.—Savoy Place, 5.30 p.m. I.E.E. Measurements and Supply Sections. "Measurement of the Winding Resistances of a 132 kV Power Transformer in Service," by Dr. K. J. R. Wilkinson and J. D. Harmer. (Joint meeting.)

At the Royal Society of Arts, John Adam Street, 7 p.m. Incorporated Plant Engineers, London Branch. Open Forum.

MANCHESTER.—Engineers' Club, Albert Square, 6.15 p.m. I.E.E. North-Western Centre. "Continuity of Electricity Supply," by H. Leyburn.

Wednesday, 3rd February

BIRMINGHAM.—James Watt Hall, Great Charles Street, 7 p.m. Junior Institution of Engineers, Midland Section. "Sintered Component Manufacture," by B. H. Swann.

EDINBURGH.—12, Rothesay Place, 7 p.m. I.E.S. Edinburgh Centre. "The Lighting of Modern Ocean Liners," by T. Catten.

GLASGOW.—At the Institution of Engineers and Shipbuilders, 7 p.m. I.E.E. South-West Scotland Sub-Centre. "Industrial Switchgear," by K. M. Street.

HARRINGAY.—"Queen's Head," 677, Green Lanes, 7.45 p.m. A.S.E.E. North London Branch. "Modern Application of Magnets," by F. G. Tyack.

HAYES.—I.E.E. London Students' Section. Visit to Electric & Musical Industries, Ltd., at 2.30 p.m.

MIDDLESBROUGH.—Cleveland Scientific and Technical Institute, 6.30 p.m. I.E.E. Tees-Side Sub-Centre. Address by H. Esther, chairman of the North-Eastern Centre.

NEWCASTLE-UPON-TYNE.—Roadway House, 8, Oxford Street, 6.15 p.m. I.E.S. Newcastle Centre. "Light and Other Radiations in the Detection of Crime," by C. H. Edlin.

PORTSMOUTH.—Municipal College, 6.30 p.m. I.E.E. Southern Centre. "Network Analysers for A.C. Systems," by A. W. Hales. (Joint meeting with the Southern Students' Section.)

PRESTON.—49a, Fishergate, 7.30 p.m. A.S.E.E. Preston Branch. "Ductube System," by J. C. Angles.

RUGBY.—College of Technology and Arts, 6.30 p.m. I.E.E. Rugby Sub-Centre. "Technical Arrangements for the Sound and Television Broadcasts of the Coronation Ceremonies on 2nd June, 1953," by W. S. Procter, M. J. L. Pulling and F. Williams.

SOUTHAMPTON.—Polygon Hotel, 7.30 p.m. Incorporated Plant Engineers, Southampton Branch. "Heat Pumps," by O. Lyle.

SWANSEA.—Y.M.C.A., 6.30 p.m. I.E.S. Swansea Group. "The Architect's Approach to Artificial Lighting."

Thursday, 4th February

CARDIFF.—S. Wales Electricity Board, The Hayes, 5.45 p.m. I.E.S. Cardiff Centre. Colour and Dress Display.

CROYDON.—Café Royal, North End, 8 p.m. A.S.E.E. South London Branch. "Rectifiers," by K. B. Blake.

GLASGOW.—At the Institution of Engineers and Shipbuilders, 7 p.m. British Institution of Radio Engineers, Scottish Section. "Electronics in Film Making," by W. D. Kemp and B. R. Greenhead.

GLOUCESTER.—2, St. Aldate Street, 6.30 p.m. I.E.S. Gloucester and Cheltenham Centre. "The Electrical Installation in a Nylon Yarn Factory," by B. C. Robinson.

LIVERPOOL.—Electricity Service Centre, Whitechapel, 7 p.m. British Institution of Radio Engineers, Merseyside Section. "Microwave Test Gear," by J. Bilbrough.

LONDON.—Savoy Place, 5.30 p.m. Institution of Electrical Engineers. "The Manchester-Kirk o'Shotts Television Radio Relay System," by G. Dawson, L. L. Hall, K. G. Hodgson, R. A. Meers and J. H. H. Merriman. (Radio Section paper.)

Manson House, Portland Place, 7.30 p.m. Institute of Welding, North London Branch. "Avoiding Fatigue in Welded Structures," by Dr. R. Weck.

4, Grosvenor Gardens, S.W.1, 6.30 p.m. Institute of Metals, London Local Section. "Germanium and Silicon," by R. W. Douglas.

MANCHESTER.—College of Technology, 7 p.m. British Institution of Radio Engineers, North Western Section. "Police Radio, its Past, Present and Future Possibilities," by I. Auchterlonie.

NOTTINGHAM.—E.M.E.B. Smithy Row, 6 p.m. I.E.S. Nottingham Centre. "Natural and Artificial Lighting in Factories," by W. A. Allen.

PETERBOROUGH.—Eastern Gas Board's Theatre, Church Street, 7.30 p.m. Incorporated Plant Engineers, Peterborough Branch. "Feed Water Treatment," by H. Taylor.

Friday, 5th February

BIRMINGHAM.—Grand Hotel, 6.30 p.m. I.E.E. South Midland Centre. Annual dinner.

LIVERPOOL.—9, Whitechapel, 7.30 p.m. A.S.E.E. Liverpool Branch. Films.

LONDON.—Dorchester Hotel, Park Lane, 7 for 7.30 p.m. Institution of Mechanical Engineers, Automobile Division. Dinner and dance.

Townsend House, Greycoat Place, 7 p.m. Junior Institution of Engineers. Film evening.

MANCHESTER.—Café Royal. Incorporated Plant Engineers, Manchester Branch. Dinner and dance.

SOUTHSEA.—South Parade Pier Pavilion. E.I.B.A. Hants and Dorset Branch. Annual ball.

SWANSEA.—I.E.S. Swansea Group. Annual dinner and dance.

Saturday, 6th February

TEDDINGTON.—I.E.E. London Students' Section. Visit to National Physical Laboratory at 10 a.m.

E.I.B.A. Branch Activities

A MEETING of the Essex Branch of the Electrical Industries Benevolent Association is to be held on Tuesday next at the offices of the Eastern Electricity Board, 81–85, High Street, Brentwood, at 4 p.m., at which the Branch Committee will be reconstituted to be more representative of the various branches of the electrical industry and of the geography of this area.

The general meeting of the North Staffs Branch of the Association will be held on 16th February at 5.45 p.m. in the lecture hall at 31, Kingsway, Stoke-on-Trent. The Branch has arranged a buffet dance to be held on 12th March next at the Grand Hotel, Hanley. Tickets will be £1 1s each.

NEW PATENTS

Electrical Specifications Recently Published

The numbers under which the specifications will be printed and abridged are given in parentheses. Copies of any specification (2s 8d each including postage) will be obtainable after 10th March from the Patent Office, 25, Southampton Buildings, London, W.C.2.

1945

11450. Western Electric Co., Inc.—Radar devices. 4th May, 1945. (705361.)

1948

28302. Benjamin Electric, Ltd., and Smith, H. L.—Lighting fittings. 1st December, 1949. (705052.)

1949

29482. Metropolitan-Vickers Electrical Co., Ltd.—Railway signalling systems. 2nd October, 1950. (705366.)

32160. Electric & Musical Industries, Ltd. —Automatic gain control circuits. 4th December, 1950. (705368.)

1950

9473. Isotope Developments, Ltd., and Fearnside K.—Means for discharging static electricity 18th April, 1951. (705255.)

12627. British Thomson-Houston Co., Ltd., and Baker, B. S.—Soldering apparatus incorporating piezo-electric transducers. 14th June, 1951. (705157.)

15892. British Thomson-Houston Co., Ltd., and Scott, W. J.—Vacuum pumps of the vapour jet type. 18th June, 1951. (705160.)

20032. British Electrical & Allied Industries Research Association.—Arc welding equipment. 10th August, 1951. Cognate application 10437, 3rd May, 1951. (705164.)

23245. Electric & Musical Industries, Ltd. —Servo-mechanisms. 5th September, 1951. (705168.)

29064. Allen, Sons & Co., Ltd., W. H., and Smith, F. S.—Blade supporting and casing arrangements for elastic fluid or gas turbines. 15th November, 1951. (705381.)

31620. General Electric Co., Ltd.—High frequency electric heating apparatus for heat treating metal articles. 31st December, 1951. (705172.)

1951

746. Siemens-Schuckertwerke Akt.-Ges.— Manufacture of magnetic elements. 10th January, 1951. (705271.)

1632. British Thomson-Houston Co., Ltd. —High pressure tanks. 22nd January, 1951. (705272.)

4716. Ferranti, Ltd.—Fault-indicating apparatus. 12th May, 1952. (705390.)

4880. British Thomson-Houston Co., Ltd. —Water-repellent compositions. 28th February, 1951. (705277.)

6387. English Electric Co., Ltd.—Electrically propelled vehicles. 7th March, 1952. (705394.)

6429. British Thomson-Houston Co., Ltd. —Resilient mountings for cylindrical members. 12th February, 1952. (705178.)

6902. Laurence, Scott & Electromotors, Ltd., and Langham, E. M.—Electrical system for controlling the feed to a reeling motor in installations for the treatment of strip material. 24th March, 1952. (705179.)

8191. Reyrolle & Co., Ltd., A.—Electric signalling arrangements for protective or other purposes. 27th March, 1952. (705398.)

10306. Telephone Manufacturing Co., Ltd. —Magneto electric generators. 16th April, 1952. (705187.)

10433. Siemens-Schuckertwerke Akt.-Ges. —Electrically heated and thermostatically controlled hotplates. 3rd May, 1951. (705076.)

10663. Petcar Research Corporation.— Method of manufacturing electric cable. 7th May, 1951. (705288.)

11545. Standard Telephones & Cables, Ltd.—Machines for sorting articles. 17th May, 1951. (705190.)

11667. English Electric Co., Ltd.—Electrically propelled rail vehicles. 2nd May, 1952. (705409.)

11685. General Electric Co., Ltd., and Dyott, R. B.—Couplings for electromagnetic waves between coaxial transmission lines and wire waveguides. 9th May, 1952. (705192.)

12811. Homann, W. (trading as Homann-werke W. Homann).—Cooking plates for gas and electric cookers. 31st May, 1951. (705410.)

13433. Marconi's Wireless Telegraph Co., Ltd.—Ultrasonic wave absorption apparatus. 6th June, 1951. (705080.)

13607. Watson, W.—Apparatus for radiography and X-ray fluoroscopy. 5th June, 1952. (705297.)

13784. Allmanna Svenska Elektriska Aktiebolaget.—Supply circuit for starting and operating discharge lamps having filamentary electrodes. 11th June, 1951. (705081.)

15314. Electric & Musical Industries, Ltd.—Cathode-ray tube arrangements. 10th June, 1952. (705197.)

16726. Telefonaktiebolaget L. M. Ericsson. —Material for electric contacts. 13th July, 1951. (705199.)

18179. Donovan Electrical Co., Ltd.— Conveyor control systems. 1st August, 1952. (705204.)

18448. Edison Swan Electric Co., Ltd.— High frequency velocity modulated oscillators. 3rd August, 1951. (705423.)

18726. Hartley Electromotives, Ltd., Evans, R., and Hawkins, G. H.—Means for mounting electrical components in the walls of buildings. 7th August, 1952. (705307.)

19130. Igranic Electric Co., Ltd.—Electron tube circuit for producing voltages of peaked waveform. 14th August, 1951. (705426.)

21194. Marconi's Wireless Telegraph Co., Ltd.—Ultra-short-wave radio communication and radar systems. 13th June, 1952. (705209.)

21741. Electrolux, Ltd.—Electrically operated absorption refrigerating apparatus. 17th September, 1951. (705317.)

22633. Modern Telephones (Great Britain), Ltd.—Telephone instruments. 29th September, 1952. (705430.)

22725. General Electric Co., Ltd., and Sowter, A. B.—Pressure welding. 11th August, 1952. (705431.)

23048. Fortiphone, Ltd.—Telephone instruments and microphones of the moving coil type. 11th September, 1952. (705100.)

23256. Simplex Electric Co., Ltd.—Hand inspection lamps. 6th October, 1952. (705433.)

24107. Igranic Electric Co., Ltd.—Thermally responsive electric switches. 16th October, 1951. (705213.)

24838. Lichtenfeld, E.—Electric current collectors. 24th October, 1951. (705324.)

25557. Williams Proprietary, Ltd., and Cook, F. L.—Combined electric switches and connecting means. 1st November, 1951. (705104.)

25630. Revo Electric Co., Ltd.—Means of mounting electric hotplates in cookers. 3rd November, 1952. (705106.)

26338. Siemens Bros. & Co., Ltd.— Electromagnetic telephone instruments. 7th November, 1952. (705330.)

1952

582. British Thomson-Houston Co., Ltd. —Blade-spring snap-action devices. 8th January, 1952. (705336.)

996. Parsons, Ltd., C. H., and Handley, G. B.—Terminal blocks for electric switches. 7th August, 1952. (705225.)

1236. Uher, E.—Trembler regulator for variable-speed dynamos. 16th January, 1952. (705120.)

2395. Aircraft-Marine Products, Inc.— Electrical connector. 29th January, 1952. (705453.)

3669. Cougnard, J.—Protection of electrical apparatus from the effects of lightning. 12th February, 1952. (705228.)

4002. Siemens & Halske Akt.-Ges.— Cathodes for electric-discharge tubes. 14th February, 1952. (705126.)

4489. Western Electric Co., Inc.—Method of bonding polyethylene to rubber, particularly insulating layers of these materials of electric cables. 20th February, 1952. (705338.)

5172. Beliaeff, S. B.—Toy electric motors. 27th February, 1952. (705340.)

5987. Westinghouse Brake & Signal Co., Ltd., Simmons, A. W., and Shattock, C. F. B. —Controllers for electrically propelled vehicles. 24th November, 1952. (705462.)

6417. Philips Electrical Industries, Ltd.— Television apparatus. 12th March, 1952. (705229.)

6615. Electrical Apparatus Co., Ltd.— Arc-shoots for electric contact breaking apparatus. 14th March, 1952. (705463.)

8688. Standard Telephones & Cables, Ltd. —A.c. ringers. 4th April, 1952. (705342.)

8694. Compagnie Générale d'Electro-Ceramique.—Ducts of ceramic material. 4th April, 1952. (705128.)

10122. Svenska Turbinfabriks-Aktiebolaget Ljungstrom.—Steam or gas turbines. 22nd April, 1952. (705130.)

11833. Belling & Lee, Ltd.—Electrical cable and connectors. 9th May, 1952. (705235.)

14537. Bosch Ges., R.—Electric condenser having at least one layer capable of being burnt out. 10th June, 1952. (705353.)

14847. Igranic Electric Co., Ltd.—Electric motor control systems. 12th June, 1952. (705236.)

16829. Allmanna Svenska Elektriska Aktiebolaget.—Arrangement in electric melting furnaces. 4th July, 1952. (705358.)

20686. Felten & Guilleaume Carlswerk Akt.-Ges.—High-pressure tanks for oil filled electric cable installations. 18th August, 1952. (705145.)

21123. Standard Telephones & Cables, Ltd.—Electric-discharge devices. 22nd August, 1952. (705147.)

22932. Allmanna Svenska Elektriska Aktiebolaget.—Electrical control device. 12th September, 1952. (705242.)

25447. General Electric Co.—Variable guide blade arrangements for high temperature turbines. 10th October, 1952. (705150.)

29343. General Electric Co.—Hall effect devices. 20th November, 1952. (705248.)

CONTRACT INFORMATION

Accepted Tenders and Prospective Electrical Work

CONTRACTS OPEN

Where "Contracts Open" are advertised in our "Official Notices" section the date of the issue is given in parentheses.

Ashford (Kent).—13th February. U.D.C. Electric lamps for one year. Surveyor, 5, North Street.

Bedlington.—22nd February. U.D.C. Electrical goods for twelve months. A. K. Dennis, surveyor, Council Offices, Bedlington.

Belfast.—26th March. Electricity Department. Central evaporating plant. (See this issue.)

Bognor Regis.—10th February. U.D.C. Distribution cables, switches and fuses and socket outlet assemblies for a scheme of decorative lighting at Marine Park Gardens. (See this issue.)

Coventry.—22nd February. City Council. Electrical work in 579 dwellings, St. James Estate, Willenhall. (See this issue.)

Crosby.—16th February. Coporation. Street lighting equipment. (See this issue.)

Edinburgh.—North of Scotland Hydro-Electric Board. Lighting and heating installation for Killin substation. (See this issue.)

Haslingden.—8th February. Borough Council. 140 W sodium vapour lighting units (138) and columns, for Group "A" street lighting, Roads A.680 (part) and A.681. Lighting superintendent, Salem Street, Haslingden, Rossendale, Lancs.

Hetton (Durham).—U.D.C. Supply of electrical equipment for the year ending 31st March, 1955. Surveyor, Council Offices.

High Wycombe. — 15th February. Town Council. Street lighting. (See this issue.)

Huddersfield.—13th February. Borough Council. Electric lamps and cables for one year. Borough surveyor, High Street Buildings.

India.—BANGALORE.—5th February. Government of Mysore Stores Purchase Committee. Varnished cambric sleevings. (E.S.B. 1726/54. Ten/8117.)*

Irish Republic.—LIMERICK.—20th February. City Vocational Education Committee. Supply and installation of heating apparatus at the St. Anne's Vocational School. (E.S.B. 1819/54. Ten/8124.)*

London. — SHEPHERDS BUSH. — 19th February. Board of Governors, Hammersmith, West London and St. Mark's Hospitals. Electric lamps for one year from 1st April next. (See this issue.)

New Zealand.—WELLINGTON.—9th March. Post and Telegraph Department. 3 kW, 5 kW and 7½ kW petrol and diesel alternator sets. (E.S.B. 1834/54. Ten/8123.)*

Poole.—16th February. Corporation. Wet and dry batteries; electric wiring supplies and accessories; electric lamps; and electric water heaters for one year. J. R. Barron, borough surveyor, Municipal Buildings.

Preston.—4th March. Education Committee. Electrical installation in Ashton I County Secondary School. (See this issue.)

South Africa. — PRETORIA. — 11th February. Union Tender and Supplies Board. Electronic valves. (E.S.B. 1480/54. Ten/8097.)*

Stanley (Durham).—6th February. U.D.C. Electrical materials for the year ending 31st March, 1955. J. J. Shipston, Council Offices.

Stockport.—9th February. Corporation. Street lighting equipment. (See this issue.)

2nd March. Corporation. Lanterns, chokes and capacitors, time switches, lamps, etc. (See this issue.)

United States. — SEATTLE. — 18th February. Department of Lighting. Either four or eight 34·5 kV outdoor circuit breakers. (E.S.B. 1118/54. Ten/8093.)*

Uruguay.—MONTEVIDEO.—3rd February Administracion Municipal de Transportes Collectivos de Montevideo. Batteries for motor cars and lorries. (E.S.B. 1535/54. Ten/8102.)*

15th February. Ministerio de Salud Publica. Vertical fluoroscope units and spare tubes. (E.S.B 1536/54. Ten/8101.)*

17th February. Servicio Oficial de Difusion Radioelectrica. Television testing instruments. (E.S.B. 1571/54. Ten/8103.)*

12th March. Frigorifico Nacional. Diesel-electric generating set. (E.S.B. 1654/54. Ten/8106.)*

Wiltshire. — 5th March. County Council. Electrical installation in new divisional police headquarters, Salisbury. (See this issue.)

ORDERS PLACED

Durham.—County Council. Electrical installations in Civil Defence control centres:—Felling (£890); Jarrow (£906); Billingham (£896).—Doves (Darlington), Ltd.

R.D.C. Supply of electric wash-boilers for 144 new houses (£6 12s 3d each).—William Marshall, Ltd.

Frome.—U.D.C. Electrical installations in 64 Cornish unit houses (£2,340).—Frome Central Electrical Contractors.

London. — ISLINGTON. — Libraries and Museum Committee. Recommended. Renewal of the electrical wiring and provision of fluorescent lighting at the Sonth East Branch Library (£2,930).—Harris & Sheldon.

Newport (Mon).—Markets and Baths Committee. Electrical installation at Stow Hill Baths (£3,051).—Gwent Electric Co.

Peterborough.—City Council. Electrical installations in 98 houses on Dogsthorpe North estate (£2,170).—M. F. Hansen & Co.

Tunbridge Wells.—Corporation. Recommended. Re-lighting of Eridge Road from the railway bridge to the borough boundary (£2,664).—South Eastern Electricity Board.

Warrington.—Corporation. Rewiring of Warrington Town Hall.—Cohen Bros. (Electrical), Ltd.

Wednesbury. — Corporation. Recommended. Street lighting at Millfields estate (£2,650).—Midlands Electricity Board.

WORK IN PROSPECT

Particulars of new works and building schemes for the use of electrical installation contractors and traders. Publication in this section in no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

Atherton.—Houses (104); G. & J. Seddon, Ltd., builders, Little Hulton, near Walkden.

Birkenhead. — Houses, Overchurch estate (150), Prenton Dell (32), Abbey Buildings (12), and 11 on other estates; Borough Architect's Department.

Extensions for A. Holt & Co., Ltd., India Buildings, Liverpool, 2; Gornall, Kelly & Partners, architects, 69, The Albany, Liverpool.

Birmingham.—Technical block extensions at Fort Dunlop; S. Bentley, staff architect, Dunlop Rubber Co., Ltd.

Hostel for tubercular patients; H. J. Manzoni, city engineer, Civic Centre.

Bishop Auckland.—Houses (28) in flats, two bungalows and community hall at Coundon for the U.D.C.; surveyor, 50, North Bondgate.

Blyth.—Home for old people; county architect, County Hall, Newcastle-on-Tyne.

Bracknell.—Factory, New Town area; Racal, Ltd., 41, Kingsway, London, W.C.2.

Caernarvon.—New works in Balaclava Road; Thomas & Evans, Ltd., fruit drink manufacturers, Hannah Street, Porth.

Camborne.—Additional classrooms at Girls' Grammar School; Bazeley & Barbary, architects, 16/18, Alverton, Penzance.

Cardiff.—Out-patients' department for Ely Children's Hospital; Jones & Bishop, architects, 6/7, St. John's Square.

Cheltenham.—Factory extensions in Gloucester Road; Leonard Stace, Ltd., manufacturers, York Place, Swindon Road.

* Specifications may be inspected at the Export Services Branch, Board of Trade, Lacon House, Theobald's Road, London, W.C.1 (Chancery 4411; extension 769).

Chesham.—Dwellings (27), with community centre, Fullers Hill; L. C. Powell, architect, Norfolk House, Station Road.

Corby.—First phase of new technical college in Corporation Street (estimated cost £70,000–£80,000); county architect, County Hall, Northampton.

Coventry.—Joint maternity, child welfare and school medical clinic at Jardine Crescent, Tile Hill; city architect, Bull Yard.

Croydon. — Warehouse and offices, Wandle Road; K. R. Plowright & Co., 4, Park Street.

Dental centre, Shirley Road; education officer, Katharine Street Offices.

Cumberland.—Conversion of Epworth House, Penrith, into firemen's flats; county architect, Portland Square, Carlisle.

Dagenham.—Electric power distribution house; Samuel Williams & Sons, Ltd., Dagenham Dock.

Darlington.—Houses (28) on the Firth Moor site; R. Blackett & Son, builders, Bondgate, Darlington.

Darwen.—Rebuilding portion of paper mills; Darwen Paper Mill Co., Ltd., Lower Darwen.

Dewsbury.—Warehouse, Low Street; J. W. Horsefield & Co., Ltd., shoddy manufacturers, Carlton Mills.

Pithead baths at Thornhill Colliery; Architect's Department, Denaby Main, Doncaster.

Dudley. — Simms Lane Secondary Modern School; Hoare Lea & Partners, consulting heating engineers, 23, St. James Road, Birmingham, 15.

Durham.—Shops at Sherburn New Village for the R.D.C.; J. F. Willis, housing architect, Byland Lodge.

East Cowes.—Houses (60), Kent House estate; East Cowes Housing Association, 35a, James Street, Newport, Isle of Wight.

Eccles.—Hostel for 50 aged people at Half Edge Lane; borough surveyor.

Felling (Co. Durham).—Canteen and laboratory for the Felling Zinc Oxide Co., Ltd.; Fennell & Co., architects, Bridge End Chambers, Chester-le-Street, Co. Durham.

Gateshead.—Factory additions, Team Valley, for Havmor, Ltd., pie manufacturers; Anglo-Scottish Constructional Co., Ltd., builders, Gosforth.

Factory additions, Team Valley trading estate, for Sigmund Pumps, Ltd.; Holland & Hannen and Cubitts, Ltd., builders, Howdon-on-Tyne.

Hastings.—Shop, with dwellings over, White Rick (£31,976); Theaker Chemist, Ltd., 9, Grand Parade.

Hatfield.—Shops and licensed premises, Roe Green; Hatfield Development Committee, Newtown House, St. Albans Road.

Hemel Hempstead. — Departmental store; F. W. Woolworth & Co., Ltd., 1, New Bond Street, W.1.

Heston.—Office and laboratory building; Fairey Aviation Co., Ltd., The Airport, Cranford Lane.

Heywood.—Houses (34), Egerton Street site; James Berry, Ltd., Heywood.

Hornchurch. — Flats (36), Rainham Road, Elm Park; U.D.C. surveyor.

Hull.—Secondary school, Eastmount, Sutton (£150,817); Andrew Rankine, city architect.

Ilford.—Stock and dispatch buildings; Ilford Lane, Roden Street.

Ilkeston.—Houses (50), Kirk Hallam estate; A. O. Marshall, borough surveyor, Town Hall.

Kidderminster. — Divisional headquarters at Blakebrook; L. C. Lomas, county architect, 14, Castle Street, Worcester.

Liverpool.—Showrooms and offices at Dale Street for D. Matthews & Son, Ltd.; Tysons (Contractors), Ltd., Dryden Street, Liverpool.

London.—HAMMERSMITH.—Works extensions (£50,000); E.N.V. Engineering Co., Ltd., 4, Hythe Road, N.W.10.

HOXTON.—Factory extension; Delavelle (G. B.), Ltd., 38/46, Ormans Road, N.1.

ISLINGTON. — Dwellings (39), Basire Street; E. C. P. Monson, architect, 120, Moorgate, E.C.2.

LAMBETH.—Factory, offices, showrooms, etc., Foxley Road and Camberwell New Road (£46,000); Brixton Estate, Ltd., 22, Ely Place, E.C.1.

NEW CROSS.—Works and offices, Trundley's Way; Siggs & Chapman, Ltd., builders, Purley Way, Croydon.

Manchester. — Secondary technical school, West Wythenshawe, and classroom extensions, Burnage Grammar School; city architect, Town Hall.

Middlesbrough.—Casualty department at North Ormesby Hospital for Newcastle Hospital Board, "Dunira," Osborne Road, Newcastle-on-Tyne; P. H. Knighton, chief architect.

Houses (100), at Park End; J. Kenyon, borough surveyor, Town Hall.

Neath.—Pithead baths and medical centre, Onllwyn Colliery; National Coal Board, Cambrian Buildings, Cardiff.

Newcastle-on-Tyne.—Works at West Moor for Gibson's Readymixed Concrete, Ltd., Haddricks Mill Road, Gosforth.

Northallerton.—Houses (70), Bullamoor Road, for U.D.C.; Brierley, Syme & Leckenby, architects, 13, Lendal, York.

North Shields.—Presbyterian church, Verne Road (£14,000); Hastie D. Burton, Ltd., builders, King Street, North Shields.

Northumberland.—Children's home, Coanwood Drive, Cramlington; county architect, County Hall, Newcastle-on-Tyne.

Okehampton.—Old people's home; H. V. de Courcy Hague, architect, 97, Heavitree Road, Exeter.

Oldham.—Aged persons' flats (32), Limeside estate; Cameron & Middleton, surveyors, 21, Queen Street.

Peterborough.—Flats (80) and houses (8), Dogsthorpe North estate; city architect, Bridge Street.

Peterlee (Co. Durham).—Clothing factory for Alexandre, Ltd.; J. H. Napper, architect, Eldon Place, Newcastle-on-Tyne.

Preston. — Houses (87), Brookfield estate; Pius A. Baines & Son, Ltd., Paley Road, Preston.

Rawtenstall.—Bungalows (20), Sandy Bank, Waterfoot; D. L. Grimshaw & Co., 35/7, Burnley Road, Waterfoot, Rossendale.

Rushden.—Houses (44), Upper Queen Street estate; Council's architect, Rushden, Northants.

Stockton-on-Tees.—Shops and flats at Preston; R.D.C. surveyor.

Stourbridge.—Rebuilding of the Britannia Inn, High Street, Wollaston, for Bents Brewery Co., Ltd., Stone, Staffs; H. W. Shipley & Partners, architects, Kingscourt, Bridge Street, Walsall.

Stretford.—Showrooms and store premises, Talbot Road; F. Challis, Ltd., motor engineers, 840, Chester Road, Stretford.

Sutton Coldfield.—New kitchen block and staff dining facilities at Good Hope Hospital (£23,000); Birmingham Regional Hospital Board, 10, Augustus Road, Edgbaston, 15.

Swinton and Pendlebury.—Shops, Clifton neighbourhood unit; Bernard Taylor & Associates, architects, 9a, Market Place, Macclesfield.

Thatcham.—Houses (190); A. Blake & Sons, builders, Bath Road, Padworth, Woolhampton.

Tipton.—Extensions (new production shop), at works for the production of wagons for export and mine cars (£60,000); W. G. Allen & Sons (Tipton), Ltd., Princes End, Tipton.

Three-storey block of flats, Princes End site; housing architect.

Tynemouth.—Houses (220), Chirton Grange North estate; D. H. O'Herlihy, borough surveyor, Municipal Offices, North Shields.

Ventnor. — Pierhead buildings, for U.D.C.; Basil L. Phelps, architect, 85, High Street, Shanklin, I.O.W.

Wallsend. — Extensions to works; Clelands (Successors), Ltd., shipbuilders and repairers.

Warrington.—Houses for B.C.: F. Berry & Son (Warrington), Ltd., Causeway Works (30), D. Cooper, Ltd., Clarence Street (27), Osborne & Co. (Warrington), Ltd., Sheywall New Road (20) and W. Peak, 17, Church Street (16), all of Warrington, and Clough & Gaskell, Ltd., Billinge Road Sawmills, Wigan (24).

Wednesbury. — Foundry extensions; Hill Top Foundry Co., Ltd., Smith Road.

West Bromwich.—Works extensions, Crankhill Lane; J. H. Lavender & Co., Ltd., aluminium founders, Stone Cross.

West Ham.—Dwellings (82), Plaistow Park Road; borough architect.

West Hartlepool.—Eight shops, ten maisonnettes and seven houses on the Owton Manor estate; A. G. Sinclair, borough architect, Municipal Buildings.

West Riding.—Technical High School, Bentley (£225,000); county architect, Wakefield, Yorks.

Whitley Bay.—Child welfare centre for Northumberland County council; county architect, County Hall, Newcastle-on-Tyne.

Houses (20), Earsdon Grange estate; Castles, Ltd., builders, Closefield Grove, Whitley Bay.

Wisbech.—Divisional police station and court house on site of Old Mills Brewery; county architect, County Hall, March.

Worthing. — Flats (72), Buckingham Avenue; S. A. Gregory, Ltd., 27, Chapel Road, Worthing.

Showroom and offices; F. H. Feest, Manor Garage, High Street.

York.—Crematorium, Moor Lane; city architect.

Housing estate, Middlethorpe Lodge Farm; E. Sherry, builder, Beach Cottage, Filey.